SURFACE LAPTOP

CAN IT TAKE ON BOTH THE MACBOOK AND THE iPAD PRO?

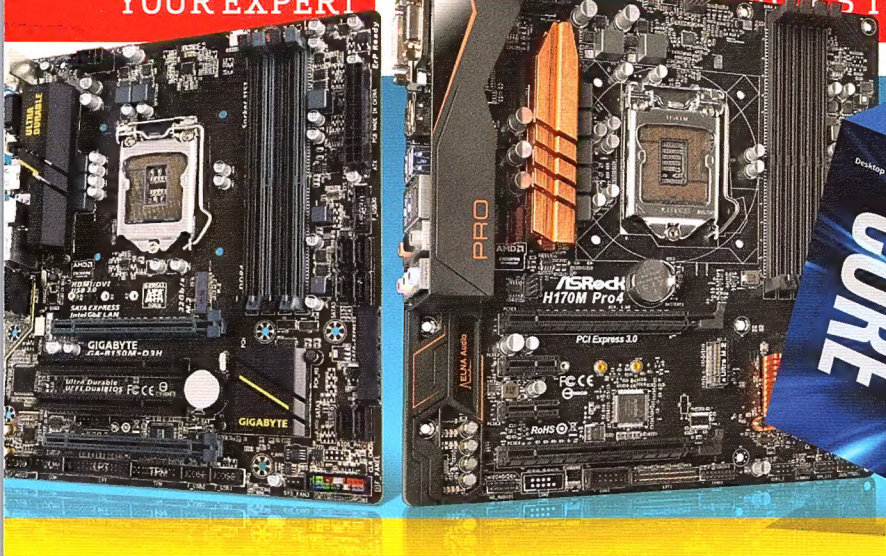
apc+

Xmas 2015
Issue 423

YOUR EXPERT [illegible] TODAY'S TECH

SMARTEST ROUTER EVER?

NEW ROUTER-MAKER PUTS THE BIG NAMES TO SHAME



LABS TESTED

6 x COMPETITIVE CPUS
8 x MODERATELY PRICED MOTHERBOARDS
10 x SCRUPULOUS SSDS
8 x PRUDENT PSUS

ULTIMATE AFFORDABLE UPGRADES

UNCOVERED: ALL THE BEST BITS FOR BUILDING A BRILLIANT BUDGET PC THIS XMAS!

LATEST TECH & GEAR TESTED

- Microsoft Surface Pro 4 tablet/laptop
- Awesome $90 home-security cam
- Extreme Z170 motherboards

NEW & FUN TECH PROJECTS

- Run Android Lollipop on your Windows PC
- Record your screen on Windows 10
- Network an old printer with a Raspberry Pi

STEAM CONTROLLER & STEAM LINK

Valve's new gamepad and streaming box: the couch-ready PC gaming revolution we've been waiting for?

13
9 313006 001362
Future
*FREE DISC NOT AVAILABLE IN NEW ZEALAND

IEEE 802.11ac Wireless and VoIP Solution for NBN (and non-NBN) Home and Business Networking

DrayTek Aust & NZ
www.draytek.com.au

NBN Ready

UFB Ready

32x VPN

Vigor2860ac / Vigor2860Vac

VDSL2/ADSL2+ & Gigabit WAN Router

- Multi-WAN with VDSL2/ADSL2+, Gigabit Ethernet WAN and USB ports for 3G/4G dongles
- Six Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1300Mbps throughput
- VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2860Vac

NBN Ready

UFB Ready

50x VPN

Vigor2925ac / Vigor2925Vac

Dual Gigabit-WAN Broadband Router

- Multi-WAN with dual Gigabit Ethernet WAN and USB ports for 3G/4G dongles
- Five Gigabit LAN ports with multiple subnets and 50,000 NAT sessions
- Two USB ports for 3G/4G USB modems, network printer, storage and USB thermometer
- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1300Mbps throughput
- VoIP (2 x FXS and 1 x FXO Line Port) for Vigor2925Vac

NBN Ready

UFB Ready

2x VPN

Vigor2132ac

Gigabit WAN Broadband Router

- Integrated IEEE 802.11ac wireless Access Point; dual band; up to 1300Mbps throughput
- 1 x Gigabit Ethernet WAN interface with security object-oriented SPI firewall and QoS
- 4 x Gigabit Ethernet LAN ports with 30,000 NAT sessions
- 2 x USB ports for USB printer, storage and USB thermometer

TAIWAN EXCELLENCE 2015

VigorAP 910C

802.11ac Ceiling Mount Wireless Access Point

- IEEE 802.11ac wireless Access Point with PoE PD port and ceiling mount housing
- Supports multiple SSID with bandwidth management per SSID
- Equipped with advanced central wireless management (AP Management)
- Up to 866Mbps Wi-Fi throughput

i-LAN TECHNOLOGY

i-LAN Technology Pty Ltd trading as DrayTek Aust & NZ

www.i-lan.com.au (02) 9838 8899 sales@i-lan.com.au

© Copyright December 2015 i-LAN Technology Pty Ltd. All rights reserved.

apc

Future Publishing Australia,
PO Box 1077, Mount Street, North Sydney, NSW 2059
Tel: 02 9955 2677 Fax: 02 9955 2688
SUBSCRIPTION ENQUIRIES: Please call Magshop 13 61 16
Email: apcmag@futurenet.com
Web: www.apcmag.com

EDITORIAL
Editor-in-Chief **Dan Gardiner**
Sub-Editor / Journalist **Carmel Sealey**
Senior Journalist **Paul Taylor**
Senior Journalist **Shaun Prescott**
Journalist **Joel Burgess**
Journalist **Stephen Lambrechts**

ART/PRODUCTION
Creative Director **Troy Coleman**
Senior Designer **Nykke Coleman**
Designer **Sharnee Brisbourne**

CONTRIBUTORS
Keith Andrew, Alice Bell, Jonni Bidwell, Helen Bradley, Nathan Brown, Alex Campbell, Simon Chester, Simon Crisp, Alan Dexter, Ian Evenden, Craig Grannell, Ben Griffin, Christian Hall, Lindsay Handmer, Leon Hurley, Paul Lilly, Ashton Mills, Jenneth Orantia, Nick Peers, Matthew Pellett, Les Pounder, Matthew JC. Powell, Alun Pughe, James Robinson, Mayank Sharma, Alan Stonebridge, Zak Storey, Nathan Taylor, Luis Villazon, Jarred Walton, Darren Yates

SENIOR MANAGEMENT
Chief Operating Officer **Neville Daniels**

COMMERCIAL
Sales Director Paul Marttila
paul.marttila@futurenet.com

ABOUT THE MAGAZINE
APC is published by Future Publishing Australia.

Distributed in Australia and NZ by Network Services.

Printed by Webstar
All contents copyright Future Publishing (Overseas) Ltd, trading as Future Publishing Australia copyright 2013. All rights reserved. While all care is take to ensure information is correct, please check prices and specifications before purchase.

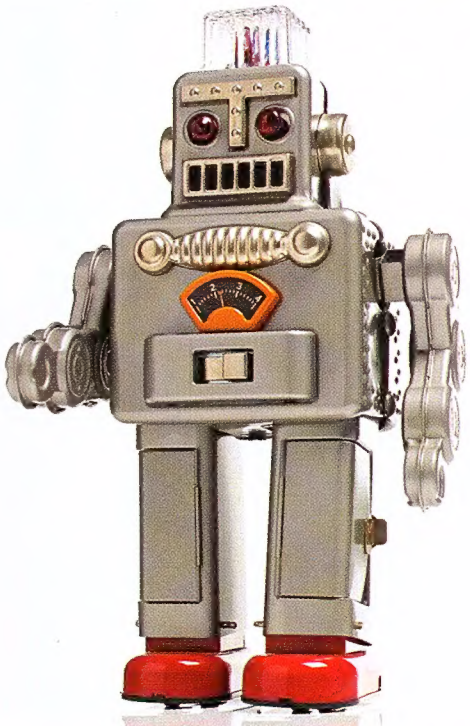
PRIVACY STATEMENT
This issue of APC published by Future Publishing Australia may contain offers, competitions or surveys which require you to provide information about yourself if you choose to enter them or take part in them (Reader Offer). If you provide information about yourself to Future Publishing Australia, Future Publishing Australia will use this information to provide you with products or services you have requested, and may supply your information to contractors to enable Future Publishing Australia to do this. Future Publishing Australia will also use your information to inform you of other Future Publishing Australia publications, products, services and events. Future Publishing Australia may also give your information to organisations that are providing special prizes or offers and are clearly associated with the Reader Offer. Unless you tell us not to, Future Publishing Australia may give your information to other organisations that may use it to inform you of other products, services or events to give to other organisations that may use it for this purpose. If you would like to gain access to the information Future Publishing Australia holds about you please contact Future Publishing Australia's Privacy Officer.

Future

ABOUT FUTURE
Future Publishing Australia is part of Future plc. Future produces carefully targeted special-interest magazines, websites, and events for people who share a passion. We aim to satisfy that passion by creating titles offering value for money, reliable information, smart buying advice, and which are a pleasure to read or visit. Today we publish more than 180 magazines, websites and events, with over 100 international editions of our magazines published under license in 30 countries around the world. Future plc is a public company quoted on the London Stock Exchange (symbol: FUTR)

Peter Allen Chairman of the Board
Zillah Byng-Thorne Chief Executive Officer

FIPP



The joy of tech

APC's editor reckons you should spend your break with tech. Oh, and family and friends too, we guess...

One side-effect of the cyclical nature of the technology industry is that, eventually, almost everything old is new again at some point – a truth that can leave even the best of us tech enthusiasts a little jaded on occasion. If you're reading APC, I'm assuming that you're a pretty tech-savvy kind of person, and that you were attracted to computers in the first place because they're both fun to play with and it's fun to make them do your bidding. That's something that can be easy to lose sight of at time, though – something I was reminded of when I recently read a fantastic op-ed from the late, great physicist Richard Feynman, contained in his 1985 memoire *Surely You're Joking, Mr. Feynman!*.

In his piece (which you can read at **tinyurl.com/apc423-feyn**) Feynman begins by remembering a time when he found himself a little down in the dumps with the current field of physics... but he realised that this was more to do with his own attitude than anything else. By remembering what made physics fun for him in the first place – the simple act of playing without a definitely goal in mind – Feynman managed to rediscover his love of the topic... and make some interesting new discoveries, despite the fact he was only 'playing'.

It's a useful anecdote to keep in mind – and its one that can be extended beyond physics to most other areas of life: learning and discovery is fun pretty much wherever you take it. If you're ever finding yourself bored with tech, then it's probably because you're not playing around enough.

The end-of-year holiday period is, of course, a great time to rediscover the joy of tech and PCs – when you can turn that free time building a new PC or upgrading your existing one, or just getting stuck into some other tech projects you've had on the back burner.

Of course, this time of year is usually spent with friends and family, too, and if you're the certified geek in those circles, that can often mean you're stuck doing tech support for some of your break as well. This year, I'd like to suggest taking a slightly different approach. Don't just fix people's problems, but teach them how to fix them themselves by sharing the techniques and tools you use, too. (The first lesson is easy: always start by Googling it.)

But however you ultimately end up spending it, I hope your break's a good one. See you next year! ■

DAN GARDINER
EDITOR-IN-CHIEF
dan.gardiner@
futurenet.com

Contents

Issue 423 Christmas 2015

ULTIMATE AFFORDABLE UPGRADES

51 UNCOVERED: ALL THE BEST BITS FOR BUILDING A BRILLIANT BUDGET PC THIS XMAS!

ALIENWARE TALKS STEAM OS AND STEAM MACHINES

WITH VALVE AIMING TO TAKE OVER YOUR LIVING ROOM, IS THIS THE END OF THE CONSOLE AS WE KNOW IT?

» features

12 ALIENWARE TALKS STEAM OS AND STEAM MACHINES
With Valve aiming to take over your living room, is this the end of the console as we know it?

51 ULTIMATE AFFORDABLE UPGRADES
Uncovered: All the best bits for building a brilliant budget PC this Xmas!

» technotes

08 NEWS
The latest developments in the tech world.

10 NUMBER CRUNCH
The numbers behind the big tech news.

14 HOW IT'S DONE
LG G4

16 GADGETS
Hot tech gear we want to own.

18 EPINIONS
See what *APC's* readers are talking about.

19 END USER
Not everything is plain sailing in the tech world.

"It's mostly close-ups on characters talking out of their hideous mouths, and they're not cute."
Minecraft: Story Mode, P113

» the lab

20 LATEST REVIEWS
20 Microsoft Surface Pro 4
22 Microsoft Surface Book
24 Lenovo Yoga 300
26 MSI GT72S Dominator
27 Aorus X7 Pro Sync
28 AMD A8-7670K
30 ASUS Maximus VIII Extreme
31 MSI Z170A Gaming M9 ACK
32 BenQ GW2765HT
33 QNAP TS-231+
35 Synology AC1900
36 DrayTek Vigor 2925Vac
37 D-Link DHP-701AV
38 Steam Controller
39 Steam Link
40 Foscam C1
40 G.Skill RipJaws MX780
41 G.Skill RipJaws KM780
41 Razer BlackWidow Chroma TE
42 Roccat Aluma
42 Plantronics GameCom P80
43 Sony Xperia Aqua M4
43 Sony Xperia Z5

44 SOFTWARE REVIEWS
44 Windows software
45 Apple Mac software
46 iOS App Store
47 Google Play (Android)
48 Windows Phone apps
49 Linux apps

22 MICROSOFT SURFACE BOOK

26 MSI GT72S DOMINATOR

38 STEAM CONTROLLER

20 MICROSOFT SURFACE PRO 4

» how to

72 QUICK TIPS
We fix readers' computing problems.

76 TUTORIALS
76 Get to grips with the Windows 10 Control Panel
80 Record your screen in Windows 10
84 Keep up to date with Apple News
86 Securely empty the Trash in OS X El Capitan
88 Set up a secure FTP for file sharing
90 Be efficient and recycle your macro code

92 MASTERCLASSES
92 PC Builder: Caged power, all on display
96 Raspberry Pi: Pi is for printing
100 Android: Virtualise Android Lollipop on your Windows PC
104 Arduino: Arduino Wi-Fi – Part 2
106 Coding: Making your own GUI apps

» downtime

110 GAMES
High-performance playtime.

114 CHIP CHAT
News from the world of geekdom.

» on the disc

- **Ashampoo Photo Commander 12**
- **Abelssoft PDF Compressor.**
- **5 Awesome Productivity Tools**
  Cold Turkey
  Inkscape
  Trillian
  TeamViewer
  Filezilla

Find your disc inside on page 83. (Australian edition only.)

FIND YOUR FREE DISC INSIDE ON PAGE 83.
(Australian edition only.)

SUBSCRIBE TO *APC* AND GET 24 ISSUES FOR $110

24 ISSUES FOR ONLY $110

WHY SUBSCRIBE?

- Take advantage of our trial subscription offer of six issues for $45 if you choose to auto-renew*
- Or get 12 issues of Australia's favourite tech mag for only $60!
- Save even more, with 24 issues for $110. That's only $4.59 per issue!
- Free delivery of every issue straight to your door
- Free disc with exclusive software in every issue**

SURFACE LAPTOP
CAN IT TAKE ON BOTH THE MACBOOK AND THE iPAD PRO?
apc
Xmas 2015
Issue 423
YOUR EXPERT
SMARTEST ROUTER EVER?
NEW ROUTER-MAKER PUTS THE BIG NAMES TO SHAME
LABS TESTED
6 x COMPETITIVE CPUS
8 x MODERATELY PRICED MOTHERBOARDS
10 x SCRUPULOUS SSDS
8 x PRUDENT PSUS
ULTIMATE AFFORDABLE UPGRADES
UNCOVERED: ALL THE BEST BITS FOR BUILDING A BRILLIANT BUDGET PC THIS XMAS!
LATEST TECH & GEAR TESTED
Microsoft Surface Pro 4 tablet/laptop
Awesome $90 home-security cam
Extreme Z170 motherboards
NEW & FUN TECH PROJECTS
Run Android Lollipop on your Windows PC
Record your screen on Windows 10
Network an old printer with a Raspberry Pi
STEAM CONTROLLER & STEAM LINK
Valve's new gamepad and streaming box: the couch-ready PC gaming revolution we've been waiting for?
Future

FREE DELIVERY TO YOUR HOME OR OFFICE EACH MONTH

SAVE UP TO $128!

HURRY

OFFER ENDS JAN 6TH, 2016!

TWO EASY WAYS TO SUBSCRIBE TO *APC* MAGAZINE

VISIT www.magshop.com.au/future

OR

CALL 13 61 16 and quote M1513APC

TERMS & CONDITIONS This offer expires January 6th, 2016, and is available to subscribers within Australia only. Please allow 6-8 weeks for delivery of your first issue. For full terms and conditions, see www.magshop.com.au/future. Please see our privacy policy on page 3. *Six issues for $45, then $45 charged to your credit or debit card every six issues thereafter on auto-renewal. **Disc only included with AU copies, NZ content is downloadable.

technotes

» INSIDE APC

Inside APC

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, *APC* still still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

technotes

» NEED TO KNOW

Tim Cook declares the PC dead while launching iPad Pro

Except the iMac and MacBook, of course...

Apple CEO Tim Cook has declared the PC more or less dead... now that the iPad Pro has arrived on the scene. And while we can't blame the man for being enthusiastic about his company's newest product, it's safe to say that his comments could be construed as a tad hyperbolic.

Speaking to British newspaper The Telegraph, Cook asked, "Why would you buy a PC anymore? No, really, why would you buy one?" to which we imagine his interviewer responding with an awkward collar tug. Cook went on to describe the iPad Pro as "a replacement for a notebook or a desktop for many, many people", boldly claiming that "they will start using it and conclude they no longer need to use anything else, other than their phones."

But where does this leave Apple's iMac and MacBook lines? Though Cook insists that the iPad Pro could easily replace your PC, the CEO believes that it probably wouldn't be a suitable replacement for those products. Of course, he does.

Stephen Lambrechts

Facebook rolling out Minority Report-style targeted ads

Is Facebook taking its background location monitoring too far?

If you thought the annoying and intrusive targeted advertisements predicted by the film Minority Report were pure science-fiction, think again — Facebook has taken a significant step towards that future by making its US users' locations and personal data histories available to brands so that they can peddle their wares directly to them.

According to the tech website The Register, brands will be able to see all the shoppers who have engaged with their advertisements on Facebook over a 28-day period. Thankfully, the data taken will be aggregated and anonymised, so people won't be blasted by ads that are calling them out by name. But is this another instance of Facebook getting carried away? Users of the DTEK app bundled with the BlackBerry Priv have discovered that WhatsApp regularly raids its users address books, which The Register suggests is the real reason Zuckerberg and Co. bought the generic chat app. **Stephen Lambrechts**

Steam Machines slower than Windows 10 for gaming?

SteamOS not as good as we'd hoped, it seems.

If you've been eagerly anticipating the arrival of Alienware's Steam Machine, prepare to get steaming mad — according to Ars Technica, the PC-like gaming console doesn't fare well against a real PC with similar hardware. Apparently, SteamOS can't compete with Windows 10 when it comes to game performance, dropping dozens of frames per second. Let's hope it's just a matter of optimisation.
Stephen Lambrechts

New DMCA rules a boon for abandonware

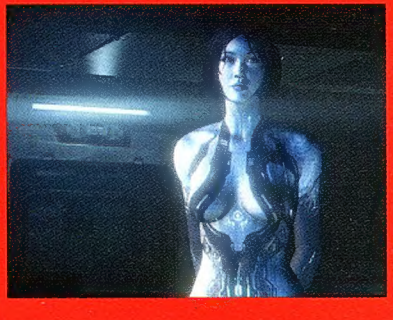
Cuts gamers some slack.

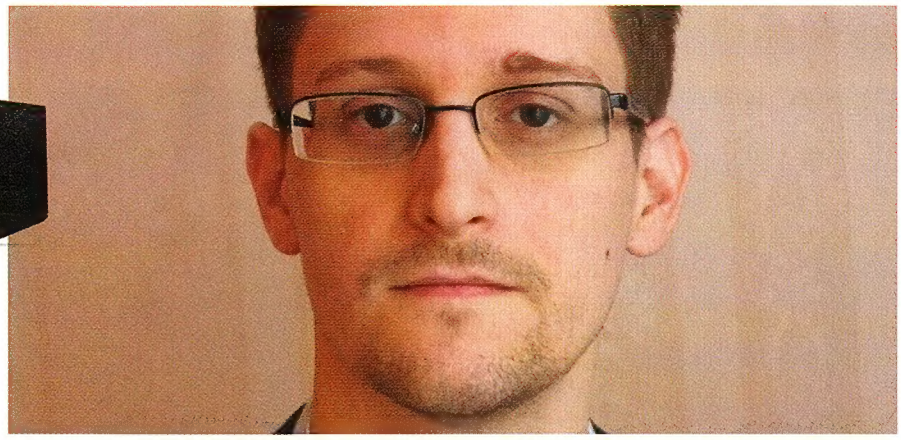
Though the Digital Millennium Copyright Act (DMCA) has always been clear on the laws regarding the copying of games, it's been revealed that an exemption is being made for games that no longer have authentication servers to connect to. The exemption allows the "copying and modification of the computer program to restore access to the game", so long as it was lawfully obtained.
Stephen Lambrechts

First major update for Windows 10 rolls out

Includes Cortana for Aussies.

Microsoft's Cortana is an invaluable digital personal assistant, but I think we can all agree that she's pretty useless when it comes to bushranger trivia… until now! An updated version of Cortana for Australian users now sports an Aussie accent, described as being somewhere between Melissa George and Margot Robbie. She'll now be able to identify Australian landmarks and even sing a local lullaby.
Stephen Lambrechts





European Parliament backs Snowden

Opposes US extradition of controversial hacker-activist.

Though the United States Government has been calling for the extradition of ex-NSA contractor and secret spiller Edward Snowden for some time now, it will have to keep on waiting, as the European Parliament has voted in favour of backing the controversial hacktivist.

A nonbinding resolution has been passed that aims to "drop any criminal charges against Edward Snowden, grant him protection and consequently prevent extradition or rendition by third parties".

Speaking from his Twitter account, Snowden described the vote as a "game changer", also stating that it's not "a blow against the US Government, but an open hand extended by friends", also describing it as "a chance to move forward".

Though the European Parliament believes that "too little has been done to safeguard citizens' fundamental rights following revelations of electronic mass surveillance", the US is sticking to its guns, with National Security Council spokesman Ned Price stating that Snowden "should be returned to the US as soon as possible, where he will be accorded full due process". **Stephen Lambrechts**

Google engineer calls out crappy cable makers

Buyer beware.

Not all cables are created equal. You might already know that, but to drive the point home, an engineer at Google decided to leave user reviews on Amazon for a variety of USB Type-C cables.

Benson Leung has a vested interest in weeding out crappy Type-C cables. He helped create two Pixel products that use the Type-C connector and take advantage of its related technologies, such as Power Delivery, Alternate Mode, and USB 3.1.

"It really is an amazing little connector," Leung says. "However, now that there are more and more Type-C products rolling out from Nexus, One Plus, Nokia and more, this I have found painfully true: USB Type-C will only be as good as its ecosystem, and more specifically, the worst of its ecosystem."

Leung said he decided to review USB cables on Amazon because he's "fed up with the early cables from third-party vendors that so blatantly flaunt the specification", and he wants to "hold them to task".

More than just annoyance, Leung says a poorly made cable doesn't just result in "weird behavior", it's actually "downright dangerous" to use. He notes this in some of his reviews, including a CableCreation USB 3.1 Type-C (USB-C) to Standard Micro USB B Female Adapter, which he states "may cause damage to your USB charger, PC or hub".

Of that cable, he says that it doesn't follow the USB Type-C specification for power delivery identification, because it advertises itself as 3A capable "but that is not appropriate because this is a legacy host port adapter".

Some symptoms he noted in his reviews are less harmful, though, like not being able to charge the Chromebook Pixel.

It's not all bad news (and reviews). Some cables pass muster and earned a five-star rating from Leung, including iOrange-E's 6.6-foot braided Type-C cable. That one exceeded his expectations, he says.
Paul Lilly

40 years

THE TIME IT TOOK TO GET FIVE MINUTES OF JETPACK AIR TIME.
David Mayman, the US-based Australian CEO of Jetpack Aviation, launched one of his jetpack prototypes alongside his Hollywood inventor partner Nelson Tyler in front of the Statue of Liberty and a crowd of amazed spectators early in November. This jet-enhanced turbine-engine jetpack is small enough to fit in your car, can take off vertically and has been some 40 years in the making. **JB**

5x

THE AMOUNT OF MAC MALWARE IN 2015 VERSUS THE TOTAL FROM THE PREVIOUS FIVE YEARS.
Traditionally, the larger market share of Windows machines has meant that the brunt of the world's malware has been developed for the Microsoft platform. But as the Mac continues to eat into this, Apple devices have started to become a juicier target — especially since many Mac owners don't run anti-malware software of any kind. That's led to increasing amounts of malicious software being discovered on OS X, including a two-and-a-half month study by researchers at the digital security company Bit9 who found a veritable explosion in Mac malware. That said, the total amount of malicious software on Mac is still just a fraction of what you'd find on Windows in a single hour. **JB**

US$1 MILLION

THE PRIZE MONEY CLAIMED FOR HACKING THE IPHONE.
Over the past few years, companies like Google and Facebook have started offering 'bug bounties', inviting coders to dig up new security vulnerabilities in their software in exchange for cash prizes. But since the dubious business model of one hacking tools distributor (Hacking Team) was exposed earlier in the year, a couple of startups have taken this idea and run with it, offering prizes for exploits that they then intend to sell off to the highest-bidding government agency. One of these startups, Zerodium, just gave out a US$1 million prize to a hacker for a currently unknown remote full jailbreak of iOS devices. **JB**

600,019

THE NUMBER OF AUSSIE ISP METADATA DISCLOSURES LAST YEAR.
According to new data released, over the course of 2014 and 2015, Australian authorities made over 800,000 requests for information from Aussie telcos. In over 600,000 cases, those requests were granted in some capacity or another, although it's difficult to know exactly what data was disclosed, or how many instances each of these approvals represents. It's worth noting that these disclosures were all recorded before the government kicked off its new mandatory metadata-retention scheme. **JB**

15 BILLION

THE BLOWOUT COSTS ASSOCIATED WITH NEW NBN ROLLOUT PLAN.
In August, the quote for the Coalition Government's new Multi-Technology Mix (MTM) NBN plan was revealed as being between $5 and $15 billion more expensive than the Labor Government's previous FTTP model. At the time, then Communications Minister Malcolm Turnbull blamed the former NBN administration, accusing it of inaccurate accounting. Former NBN CEO Mike Quigley recently struck back, however, stating that the added expense was due to the complexities of moving to the MTM plan. At the NBN's quarterly briefing in November, CEO Bill Morrow further clarified, explaining that an $8 billion spike in peak funding costs was 'mostly' to do with the two new NBN technologies. **JB**

ASRock®

FATAL1TY GAMING GEAR

GET THE GEAR USED BY THE PROS

FATAL1TY 100 SERIES GAMING MOTHERBOARDS

ALTECH COMPUTERS
www.altech.com.au

ACHIEVA GROUP OF COMPANIES
www.achieva.com.au

INGRAM MICRO® Partner Smart

NSW		
ARC Computers	02 9748 8322	arc.com.au
Aus PC Market	02 9646 8000	auspc.com.au
Capitol Computer	02 9281 8890	capitolcomputer.com.au
iBuy	02 9599 0698	ibuy.com.au
IJK	02 9745 0877	ijk.com.au
Megaware Computer	02 9698 1593	megaware.com.au
MSY	02 9755 0668	msy.com.au
mWave	1300 727 446	mwave.com.au
Nexcom	02 4721 3457	dcomponline.com.au
North Shore Computers	02 9939 1548	nscom.com.au
PC Lan	02 9649 3288	pclan.com.au
PC Meal	02 9746 7886	pcmeal.com.au
D & D COMPUTER TECH	02 9742 3988	ddcomputer.com.au
DIY COMPUTERS	02 9897 9993	diycomputers.com.au
MAIG PTY LTD.	02 9648 2261	maig.com.au
J&W	02 8090 3332	jw.com.au

QLD		
Computer Alliance Pty Ltd	07 3420 3200	computeralliance.com.au
Game Dude Pty Ltd	07 3387 1500	gamedude.com.au
MSY	07 3290 1738	msy.com.au
Umart Online	07 3369 3928	umart.com.au
AUSCOMP COMPUTERS	07 3722 5100	auscompcomputers.com
VIC		
Computers & Parts Land	03 8542 8688	cpl.net.au
MSY Technology	03 9560 2288	msy.com.au
PC Case Gear	03 9551 0889	pccasegear.com
Centre Com Sunshine PTY	03 8311 7600	centrecom.com.au
Scorpion Tech. Computers	03 8561 3200	scorptec.com.au
NT		
PC Solutions 4 U	08 89412119	pcsolutions4u.com.au
TAS		

WA		
Austin Computer	08 9201 2788	austin.net.au
MSY	08 9344 1002	msy.com.au
Netway Computers	08 9332 0888	netwaycomputers.com
Netplus Micro Computers	08 9242 7288	netplus.com.au
PC West	08 6398 4813	pcwest.com.au
PLE Computers	08 9309 4771	ple.com.au
Worldwide Net Solutions	08 9375 9666	netsolution.com.au
ARROW COMPUTERS	08 9258 7733	arrowcomputers.com.au
SA		
Hypernet Computer Distribution	08 8340 2021	hypernetdist.com.au
MATS Systems	08 8186 2110	mats-systems.com.au
MSY Technology (SA) Pty Ltd	08 8212 1656	msy.com.au
IT&Computers	08 8186 2736	itwarehouse.com.au
Photech Computers Pty Ltd	08 8349 4334	photech.com.au

www.asrock.com
FATAL1TY.COM

- The specification is subject to change without notice.
- The brand and product names are trademarks of their respective companies.
- Any configuration other than original product specification is not guaranteed.
- The Fatal1ty name, Fatal1ty logos and the Fatal1ty likeness are registered trademarks of Fatal1ty, Inc., and are used under license. © 2014 Fatal1ty, Inc. All rights reserved. All other trademarks are the property of their respective owners.

Alienware's Steam Machine will come with various CPU and storage solutions, but no SSD.

ALIENWARE TALKS STEAM OS & STEAM MACHINES

With Valve aiming to take over your living room, is this the end of the console as we know it?

The PC gaming community has been waiting with bated breath to see how Valve will handle the transfer of keyboard-dedicated titles to the controller world. We spoke with Chris Sutphen, marketing manager at Alienware parent Dell, about the Steam revolution.

APC: Can you tell us what we're looking at here?

Chris: Yeah, we're actually looking at the real life, fully functioning Alienware Steam Machine. We're giving partners and press a behind-the-scenes look at a few games and talking about what this really means for the PC gaming ecosystem.

APC: You have the official Steam controller right?

Chris: Yes, we do. So we've been playing on this for the past few days, we've been rocking a couple really fun local co-op games, we've been doing some first-person shooters, we've even been doing some games like *Cities: Skylines*. And that's really what we're here to talk about, is that Steam OS and the vision of the Steam Machine is really adding to your PC ecosystem, and enabling you to play games that have traditionally been keyboard and mouse, but in a whole new fun way.

APC: Will you be able to use the Steam controller on Windows?

Chris: Yep, the Steam controller is compatible with Windows 10, and the Steam OS will support Xbox controllers.

APC: Can you tell us about the box Alienware has made?

Chris: Sure, for the Alienware Steam Machine, we actually – in partnership with Valve and Gamestop – announced a pre-order program, which is very exciting. Because I think it definitively drew a line in the sand that said Steam Machines are here, they're a real thing, that the vision is going to be alive. And we announced that, on November 10th, people will be able to get the hardware in-store or online, but if they pre-order, they'll be able to get it nearly a month in advance, so this is an early access program with limited supply.

APC: So this is going to be running Steam OS?

Chris: This will be running Steam OS and we'll have four different configurations. The entry-level configuration is at a really nice beautiful price point of $449, and that comes with a controller. That is an Intel Core i3 processor, an Nvidia GeForce GPU, which is basically an 860M class performance card, four gigabytes of memory and a 500GB hard drive. Now I will say that, with the Alienware Alpha in market, we've learned a little about what this system can and can't do, and we've heard very clearly that the 5,400 RPM drive in there wasn't meeting people's expectations, and so the hard drive that will be shipping in the Alienware Steam Machine is going to be 7,200 RPM.

APC: Are there going to be any SSD options?

Chris: No, no SSD options. But that being said, the Steam Machine is based on a PC architecture so there is full upgradability to it. Meaning that you could swap out the CPU, the hard drive, the memory and even the wireless cards if you want to.

APC: Can you also get it with Windows installed?

Chris: The Alienware Steam Machine we're going to be shipping only with the Steam OS. It's our vision to bring the people what Steam OS can deliver in a 10-foot environment with the Steam

controller and playing games in a very unique way. But if Windows is your cup of tea, and you want to stick with that, the Alienware Alpha will continue to stick around. And we'll continue to ship that with a Windows-based operating system.

Our Steam Machine has been a long time coming. We've been in partnership with Valve for over three years, and this is really a purpose-built system. I mean , the idea that you can actually take Steam OS and put it on any PC is great, but the idea that we took the time to purpose-build a system that is meant to be in the living room, I think adds a lot of value and credibility to how we're trying to extend your PC gaming experience. New games and old games are going to played in a whole new way with a whole new controller, and I believe that Alienware brings the price and the performance and the value to deliver that.

APC: If you swapped out the hard drive and you wanted to put in your own SSD, how could we reinstall the Steam OS?

Chris: We're working on that right now, specifically trying to plan how we help Alienware Alpha users, maybe who have purchased the system knowing that it's Steam Machine ready. How can we help convert them to be a Steam OS user? We're working on some of those plans right now, and needless to say, we'll absolutely support the warranty and make sure that's covered, but really it should be a pretty easy process upgrading from a Windows-based operating system to Steam OS. We'll put together some documentation to make sure that all our support teams know how to help customers do that.

APC: Will you still be selling the Alpha console for Windows?

Chris: Yeah, absolutely. Alpha will continue to live, will continue to be in the market. For Alienware, it's all about enabling any type of PC gaming experience, so if you want to stick with Windows and you love the form factor go with Alpha. If you want to try Steam OS and you understand the value that it brings, and the unique gameplay you can get with the controller, we'll have that available in the fall, as well.

APC: You mentioned you can play keyboard and mouse games with the controller. Lots of people are a little sceptical about this.

Chris: Yeah, I'll be the first to say that I was sceptical, as well. I came in and it took me a little bit of time to play with it, but I really, really enjoy it, the haptic feedback that you get from the trackpad really works nicely as you emulate a mouse. We've actually been playing games like *Cities: Skyline* which is a very traditional PC mouse game, and we've been able to have a great time.

You're going to see a lot more AAA and Indie titles come to Steam OS over the course of this year, says Chris.

There's a little bit of a learning curve compared to an Xbox controller, it's a little bit bigger and the buttons are in a different place, so you have to get used to that. But when you understand the capability of unlocking new games and new genres from your PC gaming library to be played in the living room, it's a really fun experience. Me and the Alienware guys have been rocking some *Badland* here in local co-op mode, and that's truly what the system is about, being able to play games in any type of environment you like, in a fun way, with all your friends.

APC: Is PC gaming ready to take over the living room?

Chris: You know, I wouldn't say that this is a flawless plan. I think what is exciting about it is that Valve is going to be able to uniquely shape your experience in a very quick and nimble way. They'll be able to add features and fix things very quickly on the fly, and as we get feedback from people who get to use these, and if you're lucky enough to get one in early access, as they start hitting the market later in November, we'll be able to work through some of those things and make sure that the experience is truly console-like.

APC: The biggest obstacle seems to be Linux, the majority of the Steam library doesn't run on Linux.

Chris: I'll let our gaming publishers announce titles on their schedule, because it's their opportunity to do so, but myself and a few colleagues have been around the world talking to all of the major game publishers, and I will say that sharing news about the Alienware Steam Machine and our plans and how it'll be our flagship product is getting those publishers excited to get their content library, whether it's back catalogue or new games that they'll be announcing, coming to Steam OS.

You're going to see over the summer a lot more titles and software, big AAA titles and indies, things that are going to be your favourite, are going to be coming to the Steam OS. I fundamentally believe that things like the Steam Machine are only as successful as some of the content that you can play on it.

So I have no fear or doubt that you're going to be able to play your favourite games in any of your favourite environments. And the Alienware Steam Machine can also stream any traditional title that is not Steam OS native, so with another rig in your house, you can stream that directly to your Steam Machine. ■

The LG G4 is very easy to take apart. Tweezers and a Phillips screwdriver are all the tools you need.

LG G4

LG's flagship gets stripped to the bone.

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit **www.ifixit.com**.

BACKGROUND:

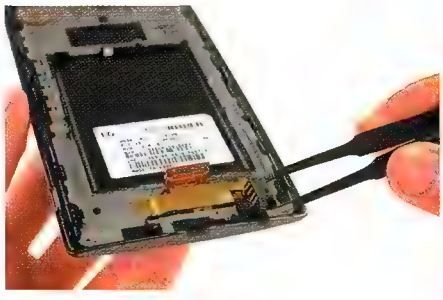
LG wasn't known for its super high-end Android flagships until it launched its widely lauded G3 smartphone. Its successor, the G4, now looks to improve and expand upon a lot of that signature phone's features. But the big question is, how easy is it to take apart and repair?

MAJOR TECH SPECS:

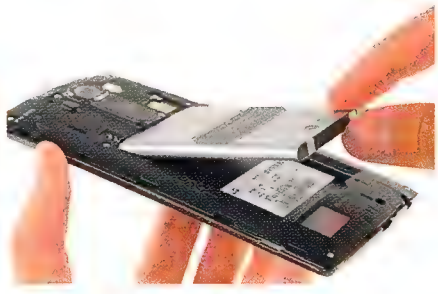
- 5.5-inch IPS WQHD display (2,560 x 1,440 at 538dpi)
- 6-core, 1.8GHz, 64-bit Qualcomm Snapdragon 808 processor
- 3GB RAM; 32GB on-board storage, expandable to 2TB via microSD card
- 16MP rear camera and 8MP front camera
- 802.11 a/b/g/n/ac Wi-Fi and NFC connectivity
- Android 5.1 Lollipop

KEY FINDINGS:

- If you need to swap out the battery on the LG G4, it's as easy as pie. Just unclip the back of the phone and replace it as you like. It's very convenient and similar to the old Samsung Galaxy S4, so no tools required. Nice.
- Unfortunately, the LG G4 doesn't support wireless charging without a specialised case. Although the snap back reveals that it does have special contacts peeking out of the plastic, these are the NFC antennas, not a wireless charging coil.
- You'll need a Phillips #0 screwdriver to get into the guts of the phone, but there's still no tri-wing screws or any other ridiculousness from LG. It's a simple matter of grabbing an opening pick and slowly easing the midframe out to reveal the inner workings.
- The 8MP selfie camera is quick and easy to remove. The main feature here is the rather controversial smoothing effect, which can be useful if you're not shooting anything that requires high levels of detail. Additionally, LG has included a super-thin 0.1mm blue IR filter to reduce infrared interference, supposedly to give photos a more authentic feel.
- The headphone jack is easily removable once you grab your trusty set of tweezers. The jack has spring contacts, which make it easy to replace as there's no soldering or fuss to deal with, just snap in to replace. It's certainly a great deal easier to fix than headphones or earbuds.
- Repairability Score: 8 out of 10 (10 is easiest to repair). The rear panel and battery can be removed using only your hands. Many of the components are modular and can be replaced independently. You only need a standard Phillips #0 screwdriver, which should be easy to find. However, the fused-display assembly means you'll have to replace the entire screen if either the glass or the LCD breaks. ■



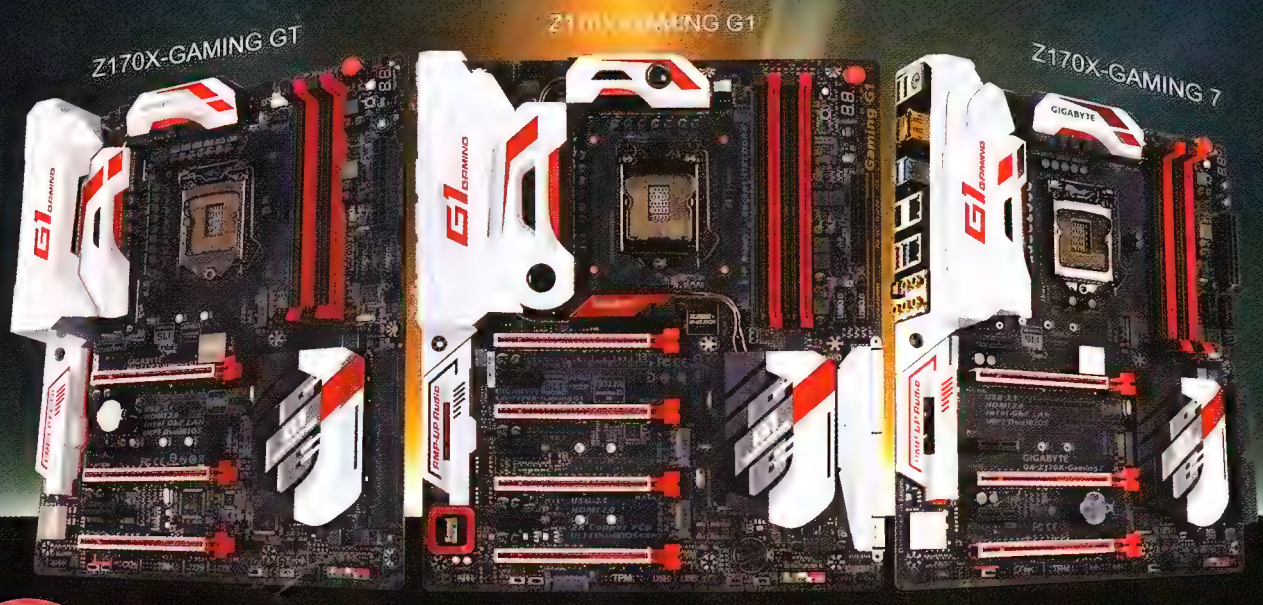
Damage your headphone jack? No problem! Cool spring contacts make for easy replacement.



Your own homegrown digits are all you need to get inside the back panel and swap out the battery.

GIGABYTE™

Thunderbolt™ 3 | Intel® USB 3.1



Free Upgrade to Thunderbolt™ 3*

GIGABYTE Motherboards with Intel® Thunderbolt™3 Support Expands!

GIGABYTE GA-Z170X-Gaming G1, GT and 7 now included in the line up

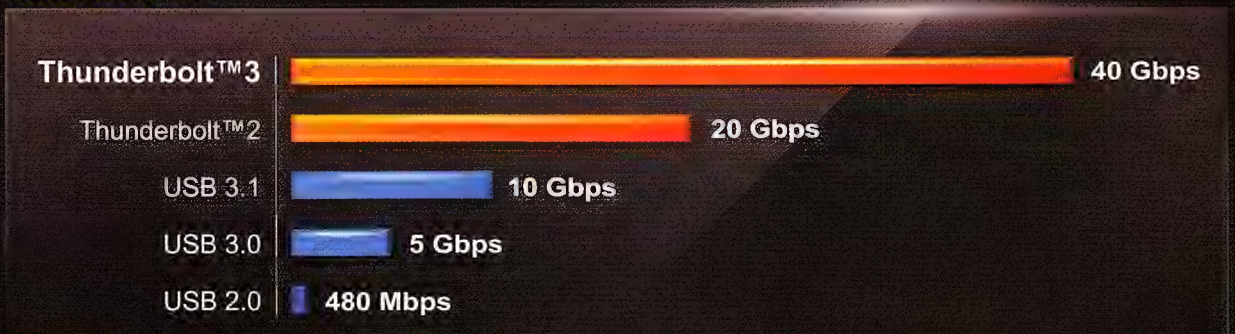
Support for Thunderbolt™ 3 on the GIGABYTE GA-Z170X-Gaming G1, GA-Z170X-Gaming GT, GA-Z170X-Gaming 7 motherboards opens up a world of new possibilities thanks to the increased bandwidth that it provides. Users can download the updated firmware today to enable support on their motherboard.

Insist on Ultra Durable
Lasting Quality from GIGABYTE

THUNDERBOLT™ 3 THE USB-C THAT DOES IT ALL

THUNDERBOLT™

HOW FAST IS IT?



HOW DOES IT WORK?

PCI Express data and/or DisplayPort video are sent simultaneously across a single, high-speed connection.

4 lanes of PCI Express Gen3 (32 Gbps)

integrated USB 3.1 (10 Gbps) host controller

Free Upgrate to Thunderbolt™3, Go to GIGABYTE Website:

For More Details About Thunderbolt™3, Go to

*Product features may vary by model.

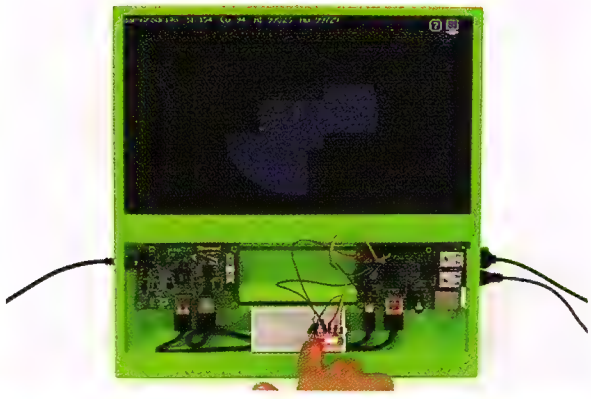
www.gigabyte.com.au

technotes

» GEAR WE WANT

PI-TOPCEED

US$99 WITH RASPBERRY PI 2 INCLUDED; US$70 WITHOUT PI 2
WWW.PI-TOP.COM



This isn't the first computer that London-based start-up Pi-Top has pumped out, debuting a US$269 Raspberry Pi 2 laptop case this time last year. Keen to sink its teeth into another project while further reducing the cost of its Raspberry Pi laptop, the company has returned to Indiegogo with a modular desktop case called the pi-topCEED. At US$99, this kit will turn a Pi 2 into a mini-desktop, comprising a small case for the Pi and 13.3-inch HD LCD screen. It's quite reasonably priced, and if you buy it with a Pi 2 included, it'll come running a modified version of Raspbian Linux, called the pi-topOS, alongside a range of educational coding games, basic office software and Minecraft. **JB**

POWERUP FPV

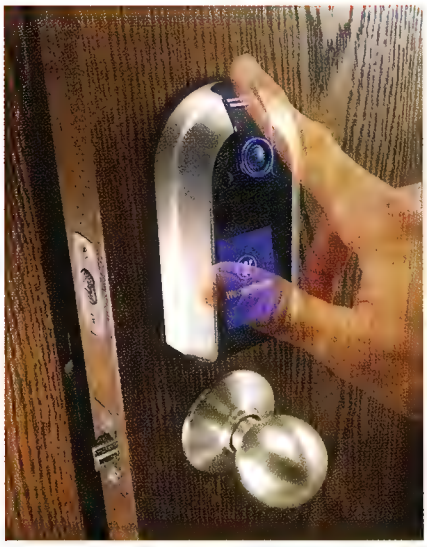
$179 | WWW.POWERUPTOYS.COM

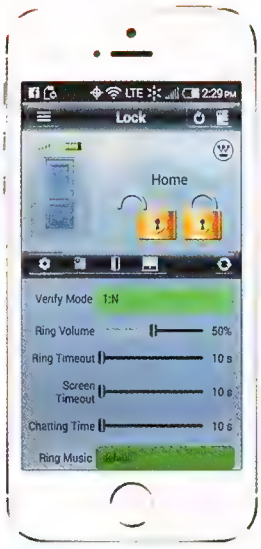
PowerUp is a US-based tech company that recently reinvented the paper aeroplane with its eponymous PowerUp 3.0 – a propeller that you mount to a paper-plane and can steer using a smartphone app. In this new venture, the company is partnered with Paris-based tech toy producer Parrot to launch a Kickstarter for an even bigger dual-propeller paper aeroplane, which will have enough lift to hold a small camera. The PowerUp FPV will be able to stream video from this paper drone to your connected device, allowing you to watch and control it remotely. The included Google Cardboard-like VR headset goes a long way towards explaining how it reached its funding goal in under four hours. **JB**

OLLOCLIP 4-IN-1 FOR IPHONE 6/6 PLUS

$129.95 | WWW.PICA.COM.AU

Gone are the days where snapping pics with the iPhone look like they were taken with a potato, but there'll always still be the occasions you wish you could have got closer to the subject or angled it better into frame. Handily clipping to your phone – and hanging on your neck with a lanyard when not – the Olloclip works with both the front and rear-facing cameras. It features a fisheye, wide-angle plus an additional 10x macro and 15x macro lense for super up-close pics, accessed by screwing off the front lens covers. It's available in a bunch of colours to compliment your style and if you're also in the market for a new phone cover , a pack is available that comes complete with one for only $30 more. **TC**





WESTINGHOUSE NUCLI

US$440 | WWW.WESTINGHOUSESECURITY.COM

Nucli is a smart lock that does away with keys by letting you unlock a door with your fingerprint. No need to worry about forgetting to lock the door, as Nucli does that for you and it can show you who is at the door and even lets visitors leave a voice message – sent to your iPhone – if you're out.

So why are we excited? No more panicking when you lose your house keys – you don't even need them with Nucli. Its security features and useful iPhone app should ensure greater peace of mind and control over your home – whether you're there or not.

We can't wait to try it. It's due to release in the US in late 2015, with no indication yet of an Australian release date.

ACTON R10 ROCKETSKATES

$699 | WWW.ROCKETSTAKES.COM

Remember those kids' shoes with wheels in the heels? RocketSkates are like those on steroids. These motor-powered boots fit over your shoes and zip you along at 12mph (just over 19km/hr). Never mind walking, this is how we want to get to work. Okay, so it's a bit childish, but what's wrong with having a little fun? RocketSkates come with an app that lets you track metrics like your speed and distance travelled, and even enables you to control the skates remotely – perfect for the mischievous pranksters out there.

And since they're available to buy right now, there's nothing stopping you from strapping on a pair.

MOCORO ROBOT CLEANING BALL

£24.99 | WWW.FIREBOX.COM

Like most things, vacuuming is best performed by bizarre robots, so put down the Hoover and get yourself an efficiently named Mocoro Robot Cleaning Ball. Despite appearances, it's not a giant pink tribble and it does not squeak.

When switched on, the ball wobbles around your room picking up dust and dirt. If it hits a door or obstacle, it changes course and goes on its merry way. It's more a bit of fun than a serious household appliance, obviously, but who says housework should be boring? If you'd like to semi-clean your house or just want something to freak out your pet cat, then you can grab one of these right now. ■

tech notes
EPINIONS

Windows 10's low system requirements mean it can run on many older devices, including netbooks.

WINDOWS 10 UPGRADE: THE SMALL BUSINESS EXPERIENCE

It was an interesting compendium of experiences on the Windows 10 upgrade in a recent issue of APC. I noticed a line asking for more comments. Here is my contribution:

Operating a virtual office with five computers on a VPN, and delivering by web, means compatibility with Windows 10 is vital. Seeing your introductory article, I first tested the upgrade using an old 32-bit Windows 7 netbook. Superb result.

So I tried a 64-bit upgrade using a Windows 7 Pro ASUS notebook. This machine had stopped working after a year of updates on the Windows 8 upgrade and couldn't be upgraded to 8.1.

Using the media creator, all went perfectly and Windows 10 ran beautifully. Then it crashed on reboot. Being off work sick, I had a fortnight to investigate. Windows 10's repeated updates of Intel chipset drivers and Nvidia graphics drivers is the problem, despite using good Windows 10 drivers available elsewhere.

I tried upgrading 11 times using different pathways – blocking updates with the Microsoft tool, killing the Wi-Fi internet connection during the upgrade (the upgrade restarts it), using the Windows Update hack and everything else I could imagine. Every time, Windows 10 was superb. Every time, it crashed irretrievably on reboot after a Windows Update. So on that machine, we're back to Windows 7 with Classic Start and Object Dock. Works as well as I could ever want.

> "Operating a virtual office with five computers on a VPN, and delivering by web, means compatibility with Windows 10 is vital."

With no 64-bit upgrade working yet, I have no confidence that our production machines will upgrade properly, so that means more trials. The real issue for us is uncontrollable Windows Updates – or specifically, with Microsoft applying wrong updates!

The Windows 10 upgrade is an easy process and it's a good OS – but forced, wrong updates are wrecking it for me. I trust you will find this little tale helpful to other readers.

Max Williams

WINDOWS 10 ON COVER DISC?

I read your magazine with great interest every month. Would it be possible to include a Windows 10 installation DVD? It's a 3.8GB download, and not everybody has unlimited internet! In my case, that would be almost my monthly allowance.

Chris Nisen

Ed replies: **We'd love to do this, Chris, and are looking into it, but certain manufacturing restrictions (centring around disc pressing) have sometimes prevented us from including Microsoft software on the disc in the past. Stay tuned.** ■

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

Paris terror renews encryption scrutiny

Anti-encryption sentiment heightens as terrorists reportedly use PlayStations to communicate. Shaun Prescott investigates.

When faced with atrocities of the scale seen in Paris last month, it can take weeks before discussion turns to the external factors surrounding it. This time, though, it was different, because the coordinated nature of the attacks immediately played into an ongoing controversy: in a climate where digital surveillance is becoming the norm, how did an event of this magnitude take us by surprise? Encryption, of course.

In the days following the attack, many outlets speculated about how the perpetrators – whom Islamic State later claimed responsibility for – coordinated their efforts. Some went so far as to suggest Sony's PS4 console was used thanks to its advanced and seemingly impenetrable encryption.

One contributor to Forbes even suggested that terrorists might turn to Super Mario Maker in order to communicate their orders via golden stars. These claims are both, one, unconfirmed and, two, seemingly ludicrous, but they demonstrate that virtually any communications medium is fair game so long as it has the capacity to transmit messages privately.

So naturally enough, encryption is back in the headlines. We addressed this topic in last month's End User, but it's worth repeating: scaling back or legislating encryption may work to the benefit of law enforcement and, therefore, everyone (assuming the law enforcement is working in the public's interest), but it can equally work to the benefit of offenders.

There's little doubt the former is a problem, though. Three days before the Paris bombings, Belgium's Interior Minister Jan Jambon indicated that the PS4 was being used by terrorist groups, though no-one has yet confirmed that it was used by perpetrators of the Paris attacks. "The most difficult communication between these terrorists is via PlayStation 4," Jambon said. "It's very, very difficult for our services – not only Belgian services but international services – to decrypt the communication that is done via PlayStation 4."

Sony responded in a manner consistent with other major platform holders: it appears the company would be prepared to cooperate in extreme scenarios, but has no intention to provide unrestricted backdoor access.

"PlayStation 4 allows for communication among friends and fellow gamers and, in common with all modern connected devices, this has the potential to be abused," the company wrote in a statement. "However, we take our responsibilities to protect our users extremely seriously and we urge our users and partners to report activities that may be offensive, suspicious or illegal.

"When we identify or are notified of such conduct, we are committed to taking appropriate actions in conjunction with the appropriate authorities and will continue to do so."

It doesn't appear to be an argument that will be resolved any time soon. Australia's prime minister – the leader of the government that pushed so hard for data retention laws – is widely known to use Wickr, a messaging service with its own lock-tight encryption. Pressure from anti-encryption advocates is only going to get stronger, though, and bleak as it is, their justifications may only grow more persuasive. That's the real power of terrorism, for you. ■

ENDUSER

Share your stories!

If you have an iteresting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

apc HOT PRODUCT

TABLET/LAPTOP HYBRID

FROM $1,349; $2,199 AS TESTED | WWW.MICROSOFTSTORE.COM

Microsoft Surface Pro 4

The Surface Pro 4 continues the family tradition and inches Microsoft's 2-in-1 closer to becoming the perfect tablet-laptop hybrid.

The Surface revolution is one that got off to a pretty slow start. Microsoft's vision for a hybrid 2-in-1 tablet that can double as an ultraportable laptop has been in place since the first Surface launched back in 2012, but it wasn't really until last year's Surface Pro 3 that the design caught up with the ambition, where Microsoft really honed in on what it'd take to make its devices go from good to great.

So how exactly has the Washington company improved on last year's much-lauded design? Fine-tuning, mostly. The Pro 4 doesn't drastically diverge from the formula that finally got the Surface line over that 'ho-hum hump'. This year's update has a slightly larger display (it's grown from 12 to 12.3 inches) and a resolution bump (from 2,160 x 1,440 to 2,736 x 1,824), but Microsoft has managed to keep the chassis the same size. Well, almost – it's a tad lighter and thinner and has shaved 15g off the weight and half a millimetre off the thickness.

MORE CHOICE

There's now a wider variety of models available at a greater range of price points, too, although the cheapest will still set you back around $1,350 down under. With the exception of a handful of entry-level Core m3 options, most of the Pro 4s are based on Intel's brand-new sixth-generation Core i chips, and for this review, we tested the mid-range Core i5 model with a 256GB SSD and 8GB of RAM, which sells for $1,999 locally.

These are great-performing and power-frugal chips, and paired with the Pro 4's respectably fast SSD, that makes for a slick and quick experience when launching and switching between apps, searching within Windows and just generally tooling around. And speaking of the OS, this is also the first Surface to ship with Windows 10 preinstalled (and it's the full-fat Pro version here) and the two do work great together. This is a device that Microsoft proudly trumpets as being able to replace your tablet and laptop, and the tweaks to Windows 10 make that a much more realistic claim than on Windows 8 – particularly on the laptop side of things, where Mac-like trackpad gestures make navigating and switching between programs a lot slicker and more intuitive.

Thanks to that new hardware/OS combo, the battery life on the Pro 4 has seen improvement, too, though it's still unlikely to stretch to a full day. In our tough PCMark 8 tests, the Pro 4 lasted 3:48hr with the screen at 50% brightness; with the same settings, the Pro 3 managed only 3:16hr – a welcome improvement, if not one to really shout about. (As an aside, we're keen to check out the Core m3 model to find out what kind of impact that low-power processor has.)

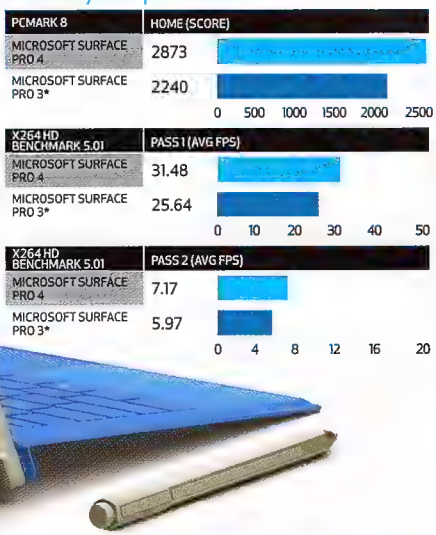
TWEAKED PERIPHERALS

The Surface Pen is the first peripheral that's been levelled up. You can now choose from multiple tip-types that will each emulate the feel of using different real-world writing implements. Our test unit had a felt-tip, but you can swap that out for ones that mimic either a pencil or ballpoint pen. The reverse end now works as an eraser by default, too, so you can draw and write in Microsoft's core apps a lot more intuitively.

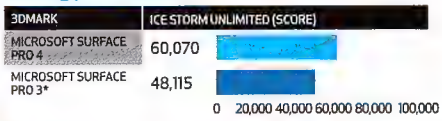
It's worth noting that those nibs are designed to wear out over time, but they do feel great to use and, as with previous Surfaces, the

LABS BENCHMARK RESULTS

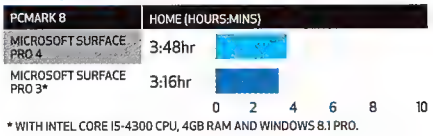
General system performance



Gaming performance



Battery life



* WITH INTEL CORE I5-4300 CPU, 4GB RAM AND WINDOWS 8.1 PRO.

handwriting experience continues to be the best you'll find on a tablet. You can move Windows's handwriting panel freely around the screen and learning to use the small set of handwriting tools is quick and mostly effortless. Even going back into text you've previously written and making corrections is frustration-free; in fact, we wrote a good portion of this review by hand simply because the Pen works so well.

The new Type Cover keyboard is even better. It's much more rigid than before and now has clearly separated chiclet keys with a good couple of millimetres between, so you can feel the edges of each when typing. There's a bit more travel in those keys, too, which all adds up to a moderately improved typing experience. It was quite adequate last generation, but with this new keyboard, it's borderline great.

What also helps is the bigger trackpad that now sports a glass top – what MacBooks have had for generations – and it goes some way to fixing what was perhaps the device's biggest hardware weakness. But while this new pad feels great under the fingertip, scrolls beautifully and works more reliably than before, we still weren't quite enamoured with it. By default, the sensitivity was set too low, and when we bumped it up, the cursor became a bit jittery, particularly when it came to making fine selections. Still, it's better than before and certainly serviceable for day-to-day use.

THIS SURFACE NEEDS A SURFACE

If the Surface Pro 4 has a significant shortcoming, it's that it still sucks to use on your lap. That freely moving kickstand works fabulously if you've got a sturdy flat surface to place it on, but trying to balance it on your thighs while you're sitting down is an exercise in frustration. As a device that's supposed to be able to replace a laptop, not working on your lap is a fairly significant shortcoming.

Since we're listing complaints, it's worth noting that the keyboard cover does not come included. Adding one of these new models will set you back an additional $200 – and the price on these keyboard covers has slowly been creeping up... the Pro 3's was just $150 at launch.

For us, neither of those is quite a deal breaker, but they are both important points to factor into any purchase decisions.

IS THIS SURFACE FOR YOU?

What's undeniable about the Pro 4 is that it's still a professional-skewed product with a premium build-quality to match and, as such, it won't appeal to everyone when it comes to your needs (or how much you're willing to pay). But if you can see yourself using the Pro 4's productivity-focused features, Microsoft's done a fantastic job of further cementing the Surface concept with this new model.

Now if it can just sort out that lap-balance problem, then it might have a 2-in-1 that will really be ready to replace both your tablet and your laptop.

Dan Gardiner

Verdict

Features ★★★★½
Performance ★★★★½
Value ★★★★

Doesn't reinvent anything radical, but further cements Surface Pro as the 2-in-1 to beat.

★★★★½

LAPTOP/TABLET HYBRID

FROM $2,299; $4,199 AS TESTED | WWW.MICROSOFTSTORE.COM

apc RECOMMENDS

Microsoft Surface Book

Extending the Surface in a new direction.

Since the first Surface launched a little over three years ago, Microsoft has aggressively pushed the 2-in-1 concept – tablets that can replace your laptop thanks to an (optional) keyboard cover that lets you have your cake and eat it too.

The new Surface Book comes at things the other way and the fact that Microsoft calls this "the ultimate laptop" on its website is a fairly telling sign of where it's aiming – it's very much a notebook first and a tablet second. And with a tough and slick-looking exterior that's hewn from the same matte-finish magnesium-alloy as the Surface tablet line, an absolutely gorgeous 13.5-inch, super high-res (3,000 x 2,000-pixel) display, the new multi-nib Surface Pen, an optional Nvidia GPU for when the going gets tough and up to 12 hours battery life, it's certainly kitted out with a lot of neat, cutting-edge tech. So is this a natural extension of the Surface 2-in-1 concept, or a wrong turn into a dodgy cul-de-sac?

PRICED FOR PROS

Starting from $2,299 in Australia – around $1,000 more than the cheapest Surface Pro 4 – and reaching all the way to $4,199 for the top-end 6th-gen Core i7/512GB SSD unit we tested, the Surface Book is decidedly priced for the pro and business market. What's more, models with that dedicated Nvidia GPU start at $2,949, so if you want the extra horsepower – which Microsoft is pitching more at content-creation (videos, images and so on) than gaming, that base model isn't an option.

Still, the design is fairly classy all round, with that accordion-style hinge the most obvious standout. It's undeniably one of the most elegant 2-in-1 docking mechanisms we've seen, seamlessly mating the display with the keyboard and locking it in place securely via a special 'muscle wire' – if you didn't know the screen was detachable, you'd think this was just a premium laptop with a thickish display.

A magnetic edge on the lip holds the screen and keyboard base securely shut, but as pics clearly demonstrate, that rounded rear hinge does mean there's always a gap between the keyboard and screen (which becomes increasingly wide the further back it goes).

Moreover, that premium build quality extends to basically every other area of the Surface Book. That means first-class inputs, with a large and responsive glass trackpad and a near-perfect chiclet keyboard – the latter feels, to us, even a bit more comfortable to type on than a MacBook, which is the laptop keyboard benchmark. That 13.5-inch IPS display uses that productivity-friendly 3:2 aspect ratio and is factory calibrated for 100% RGB coverage, meaning it's great for colour-accurate design work.

Like the Pro 4, the Surface Pen snaps securely onto the left side of the display here, and in use, offers the same advantages of direct content-manipulation. And the Book's screen can be undocked, rotated 180° and snapped back on, theoretically giving you a high-powered tablet with 12 hours battery – although it's a heavy one that needs to be used on a lap or desk, and the display doesn't sit flat due to the Book's curved hinge design.

HIDDEN HORSEPOWER

The keyboard's chassis isn't just dead space either – there's an additional battery (adding another nine hours to the tablet's claimed three hours) as well as that Nvidia GeForce GPU. Microsoft doesn't specify which GPU this is, but based on our benchmark results, it seems to be a tweaked GTX 840M – not a chip we'd outright recommend for gaming, but

"It's undeniably one of the most elegant 2-in-1 docking mechanisms we've seen, seamlessly mating the display with the keyboard and locking it in place securely via a special muscle wire."

LABS BENCHMARK RESULTS

General system performance

PCMARK 8	HOME (SCORE)
MICROSOFT SURFACE PRO 4	2,873
MICROSOFT SURFACE BOOK	2,958
MICROSOFT SURFACE BOOK (TABLET ONLY)	2,889

0 1000 2000 3000 4000 5000

CINEBENCH R15	OPENGL (FPS)
MICROSOFT SURFACE PRO 4	36.85
MICROSOFT SURFACE BOOK	38.83
MICROSOFT SURFACE BOOK (TABLET ONLY)	42.34

0 10 20 30 40 50

CINEBENCH R15	CPU (MULTI-THREADED)
MICROSOFT SURFACE PRO 4	306
MICROSOFT SURFACE BOOK	321
MICROSOFT SURFACE BOOK (TABLET ONLY)	316

0 100 200 300 400 500

Gaming Performance

3DMARK	ICE STORM UNLIMITED (SCORE)
MICROSOFT SURFACE PRO 4	60,070
MICROSOFT SURFACE BOOK	90,124
MICROSOFT SURFACE BOOK (TABLET ONLY)	67,358

0 20k 40k 60k 80k 1000k

Battery Life

PCMARK 8	HOME (HOURS:MINS)
MICROSOFT SURFACE PRO 4	3:48hr
MICROSOFT SURFACE BOOK	4:50hr
MICROSOFT SURFACE BOOK (TABLET ONLY)	1:28hr

0 1 2 3 4 5

something that will let you scrape by at about 720p (or the nearest 3:2 aspect ratio resolution you can find) in many games.

To be fair, the Nvidia graphics chip isn't really here for gaming and Microsoft is quite clear on the matter. It's intended to accelerate media-creation tasks in programs like Adobe's Creative Suite.

GIVE AND TAKE

But while the Book makes a fairly impressive laptop, as a tablet, it's something of a mixed experience. While it's incredibly (and impressively) lightweight considering its 13.5-inch footprint – just 732g, even lighter than the Pro 4 – it's not something you can really detach and take with you. Part of that has to do with battery life – Microsoft admits it's only good for three hours (we managed to get around half that in our demanding battery benchmark) and the other has to do with inputs. There's no USB port – they're all on the keyboard – so you can't easily plug in extra storage or peripherals. That means if you want the kind of flexibility that a Surface Pro offers, you'll need to lug the whole 1.59kg package around with you.

Detaching the tablet from the keyboard isn't quite as seamless as we'd like either – something that's largely caused by having dual GPUs. Before you can pull off the screen, you first need to press a button on the keyboard (or click an icon in the system tray) which releases the muscle wire. And if you have a GPU accelerated program running, you'll get a prompt saying you need to close that app before the tablet will detach – and there's no way around this.

Having the system components all behind the screen makes the Book top-heavy, too. That means if you're using it in notebook form on your lap with the screen at an obtuse angle, it can have a tendency to tip backwards.

VARIATIONS ON A THEME

Microsoft's really pitching the Book and the Pro 4 to different user needs – and choosing between them is really about picking whether you want a laptop-leaning-tablet or a tablet-leaning-laptop. The Surface Book is certainly a better laptop than the Pro – you can (mostly) use it on your lap, as the Pro's kickstand makes attempting this fiddly. And the Book certainly has the slickest docking mechanism in a 2-in-1 we've encountered. In some ways, when using the Book, we did find ourselves wishing that Microsoft would just make a Surface laptop without the tablet parts – but the company has somewhat painted itself into a corner by aggressively marketing the 2-in-1 concept.

To a degree, Microsoft has actually undermined the Book by many of the improvements it's included in the Surface Pro 4. The latter's chiclet keyboard, glass trackpad and improved stylus minimise or extinguish a lot of the Book's key advantages.

SHOWN UP BY LITTLE BROTHER

None of that makes the Surface Book a bad product – just one that's a much harder sell. It somewhat further vindicates the original Surface design too, which has improved in leaps and bounds with each new generation. Indeed, even Apple has got onboard with the idea. While Apple CEO Tim Cook may have poo-pooed the very concept of 2-in-1s, the Cupertino company's new iPad Pro sails pretty close to the Surface Pro design, what with its optional keyboard cover and stylus. (The iPad Pro arrived a little too late for us test for this issue of *APC*, but we'll have a full review next month.)

For the few professional designers and business users who think they can take advantage of the Book's unique features, this is undoubtedly a great product. But it's also quite a niche one, and if you want tablet features, it's strongly worth considering whether a Surface Pro 4 might suit you better. ■

Verdict

Features ★★★★
Performance ★★★★
Value ★★★½

A premium-quality device with impressive design, but one that's not quite an overwhelming success.

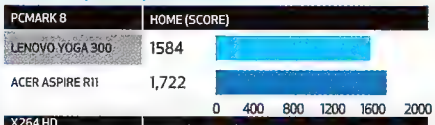
★★★★½

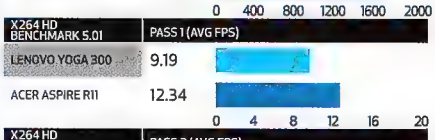
LAPTOP/TABLET HYBRID

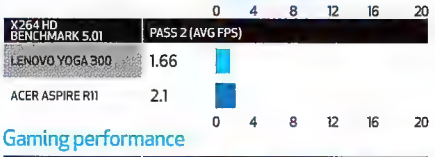
$549 | WWW.LENOVO.COM/AU

LABS BENCHMARK RESULTS

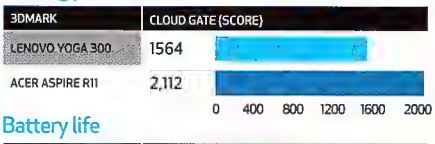
General system performance



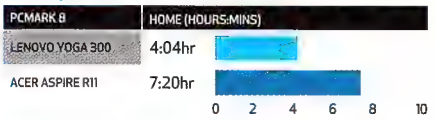




Gaming performance



Battery life



Lenovo Yoga 300

Laptop and tablet marriage might not be the best path after all.

One of the biggest perks of Windows 10 is the focus Microsoft has put on creating a seamless system transition from a touch-controlled tablet mode to the point-and-click cursor based laptop interface – and it's devices like Lenovo's Yoga 300 which are, in theory, perfectly suited to cash in on this new OS.

Now, there are bound to be some compromises in price or specs when you attempt to combine two tech categories into one device, but one of the better tacks to take with hybrids (or 2-in-1s) is to make the tablet or laptop aspect an added bonus, rather than an unrewarding additional expense. And though we can safely say that the Yoga 300 isn't definitively in the latter camp, we're also not completely sure it fits in the former either.

With a sturdy white or black plastic exterior that opens into a black aluminium veneered keyboard surround, the Yoga 300 provides a compact but usable set of keys and a decent trackpad. The silver 360° folding hinges stand out against the black-and-white exterior a little more than we'd like, but they feel solid and do a good job of keeping the device stable at a number of angles.

In terms of specs and performance, the Yoga 300 it similar to, but fractionally behind, the Acer Aspire R11 that we reviewed in APC 421 (page 19), with an Intel Celeron N3060 CPU, 4GB of memory and a 500GB hard drive (fair when you consider that the Acer costs around $50 more). The Lenovo generally performs how you'd expect with regards to tougher tasks like video encoding (not that well) and your average work and web-based activities (perfectly fine) and it gets a respectable four to five hours of battery life under general usage conditions.

The Yoga 300 has a pretty stock-standard 11.6-inch 1,366 x 736-pixel antiglare display, which looks a little faded, even with the screen brightness turned fully up. But they're the limitations that come with a budget hybrid screen that has 10-point, capacitive, touchscreen technology built into it.

At 1.39kg, the Yoga 300 is okay for a hybrid and its small footprint certainly makes it more portable than your average laptop. With two USB 2.0s and one USB 3.0 port, HDMI, Gigabit Ethernet and an SD card reader, it also offers ample ways to keep you connected. However, we did find the pre-installed McAfee security app slowed the OS to a crawl, and though you can easily uninstall it, it does slightly mar the 'out of the box' experience.

Taking a broader perspective for a moment, when you compare the Yoga 300 to something like the Kogan Atlas X14FHD laptop, the latter flaunts a bigger and better 14-inch 1,920 x 1,080-pixel display and has similar work and video playback performance, and you can pick it up for some $200 less than the Yoga 300.

On the flip side of the equation, you have Apple's iPad Mini 4 tablet – a top-of-the-line iPad in terms of processors and screen resolution – starting at around the same price as the Yoga 300. So unless you're dead certain you want a device that has the flexibility to be both a laptop and a tablet, you can do better in one or the other category at this price point. You might want to pick a side.

Joel Burgess

Verdict

Features ★★★★☆
Performance ★★★½☆
Value ★★★½☆

This 2-in-1 can arguably do it all, but not all of it is done that well.

★★★½☆

It's a work of art.

Thermaltake Core P5

Open-Frame Chassis - Available now for $179

Tt

Thermaltake

GAMING LAPTOP

$3,899 | AU.MSI.COM

MSI GT72S Dominator Pro G Dragon

The red-hot GT72S is ready to dominate.

For the past year, the fastest notebook GPU has been the GTX 980M and most didn't expect to see any changes until 2016. Shoehorning a mobile version of GM200 into a notebook seemed unlikely, as the 980M isn't even using a fully enabled GM204, and yet, it still runs into the 100W TDP limit of mobile GPUs. Faced with such an obstacle, Nvidia decided to change the game and release a notebook version of the desktop GTX 980, using a fully enabled GM204 chip.

We estimate the TDP for the notebook GTX 980 is in the 130–140W range. MSI is first out of the gate with GTX 980 in a notebook, with updated GT72 and GT80 models, but select ASUS and Clevo-based notebooks will also support the new GPU. The GTX 980 is a $500 upgrade over the GTX 980M, but Nvidia is also giving notebook vendors a lot of leeway in terms of what they do with the GPU.

Sporting a multiplier unlocked Skylake i7-6820HK processor, MSI allows BIOS overclocking of the CPU here, and GPU overclocking via utilities such as MSI Afterburner. The latter comes pre-installed, and on our test notebook, the GTX 980 came from the factory with a modest 110MHz bump in core clocks. Even with a 230W AC adapter, the combination of CPU and GPU overclocking will push the power limits — we measured over 220W peak power draw during gaming tests, without overclocking the CPU.

When it comes to gaming performance in a notebook, the GTX 980 is the new champion, and memory isn't a problem, as most vendors will be using the 8GB model. The GT72S smokes every other single-GPU laptop we've tested, but even a high-end GTX 980M SLI rig like MSI's GT80 will be hard pressed. The GT80 we looked at earlier this year is only 10–20% faster in two of our graphics tests, but it trails by 12% in *Metro: Last Light*. Even against desktops like our GPU testbed, which uses an overclocked 4.2GHz i7-5930K, the GT72S holds its own. Our desktop with a GTX 980 card posted average performance that's only 7% faster than the GT72S, albeit with the factory overclock.

We set out to see how far we could push both the CPU and GPU with overclocking by basically redlining the system, and stability wasn't totally there, but a 4GHz CPU clock with +220/300 GPU core/RAM was close. The factory overclock netted a 5% increase in gaming performance, and we increased that to a 15% boost. The system can get moderately noisy under load but that's better than other gaming notebooks, and it also stays surprisingly cool.

The GT72S is loaded with extras — multicoloured backlighting, switchable graphics with 5 hours of video playback, a USB 3.1 Type-C connector, and a 75Hz G-Sync enabled display. It's a true desktop replacement. The GT72S isn't the sort of system you want to lug around as a daily driver, but for the target audience, it doesn't get much better.

Jarred Walton

Verdict

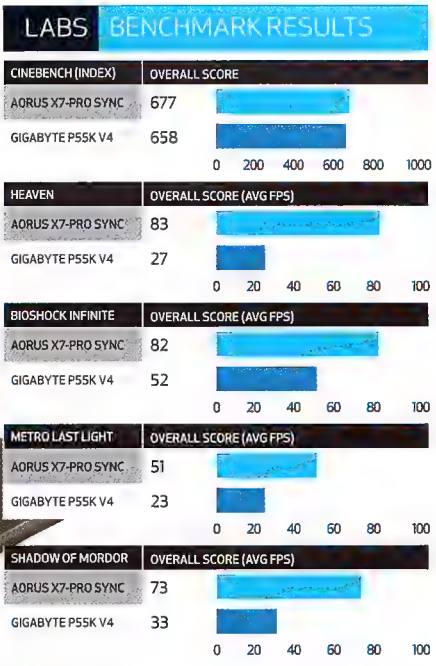
Features	★★★★½
Performance	★★★★½
Value	★★★★☆

Insanely fast; good build quality; overclockable; great features.

★★★★½

apc RECOMMENDS

LABS BENCHMARK RESULTS


CINEBENCH (INDEX)
OVERALL SCORE
AORUS X7-PRO SYNC 677
GIGABYTE P55K V4 658
0 200 400 600 800 1000
HEAVEN
OVERALL SCORE (AVG FPS)
AORUS X7-PRO SYNC 83
GIGABYTE P55K V4 27
0 20 40 60 80 100
BIOSHOCK INFINITE
OVERALL SCORE (AVG FPS)
AORUS X7-PRO SYNC 82
GIGABYTE P55K V4 52
0 20 40 60 80 100
METRO LAST LIGHT
OVERALL SCORE (AVG FPS)
AORUS X7-PRO SYNC 51
GIGABYTE P55K V4 23
0 20 40 60 80 100
SHADOW OF MORDOR
OVERALL SCORE (AVG FPS)
AORUS X7-PRO SYNC 73
GIGABYTE P55K V4 33
0 20 40 60 80 100

LAPTOP

$3,799 | WWW.AORUS.COM

Aorus X7-Pro Sync

As loud as it is beautiful.

Ladies and gents, a new dawn is upon us. G-SYNC laptops are coming thick and fast, so it's with great pleasure that we introduce the Aorus X7-Pro Sync. Unearthed from the heart of Gigabyte's notorious Aorus factories, comes this marvellous, tiny gaming powerhouse. Arguably the noisiest dual-GPU laptop ever heard, the X7 packs two Nvidia GeForce GTX 970M processors alongside an Intel Core i7-5850HQ, 16GB of DDR3L RAM, and a RAID 0 setup. This is the kind of laptop dreams are made of. *Loud* dreams.

Let's start with the good. The design of the Aorus is stunning – clean, sharp and low, all traits we normally see from the ultrabook side of the divide, as opposed to the pro-gamer. That being said, the Aorus is 22.8mm thick, in comparison to the ASUS ROG G751JY, which comes in at more than 20mm thicker when closed. The keyboard, although featuring the scissored variety of key switch, is backlit and contains five dedicated macro keys to top it all off.

And now, the bad. If you're looking for a stealthy laptop, this isn't the one for you. Although the X7-Pro packs a wonderful amount of hardware into its sleek, stealthy body, the one thing it hasn't managed to control is the fan speed. Even when sitting on a desk, the fans whir into life as soon as you open any program worth its salt. At first glance, this seems to be due to the method Gigabyte has used to chill those mighty processors. Both GPUs and the CPU are cooled using one single system, heatpipes and all, meaning that, if the CPU temp ramps up, the fans that are designed to cool both of the two GPUs also spring into life, regardless of the temperature of the graphics processors.

Gigabyte has included a fan controller, but unless you enjoy switching back and forth between the two constantly, you're going to encounter some serious thermal throttling in-game. Headsets, and closed back ones at that – that's what you'll need. Although God forbid anyone else is in the room with you at the same time as you do anything with this wee beastie.

Finally, back to the good. The screen—it's stellar. Aorus has thrown in a 17.7-inch 1080p AH-IPS G-Sync panel, and it's crisp, easy to use, and comes with plenty of screen real estate to really take advantage of that dual-GPU SLI solution. The two GTX 970Ms are a powerhouse when it comes to gaming. If you're looking for that perfectly smooth gaming experience from today's latest AAA titles, the Aorus won't let you down.

This makes the Aorus X7-Pro a stunning all-round laptop. It could easily run as either a workstation or a gaming laptop, depending on your preference. And that really brings us round to who exactly this laptop was designed for. It's the gamers (duh!), but more specifically, the streamers. If you're the kind of person who travels a lot, but just can't resist the temptation to get yourself out there into the digital stream, the Aorus X7-Pro Sync is a solid choice. It'll act as your rendering station, your gaming platform, and your traveling partner. Just remember to make sure your microphone is facing away from the cacophony that is the X7's fans, and you're all set.

■ Zak Storey

Verdict

Features ★★★★
Performance ★★★★½
Value ★★★½

Powerful; sleek; G-Sync; IPS screen; chunky RAID 0 array

★★★★

PROCESSOR

$175 | WWW.AMD.COM

AMD A8-7670K

Should AMD be powering your next low-cost desktop?

Let us sum up the experience we had reviewing AMD's A8-7670K APU. It came in a tiny little white box, sans cooler, and it's, ah, a little on the slow side.

So, after setting up our standard benchmarking platform, we installed the new CPU and began our preliminary benchmark testing. The 7870K has a total of two computational cores, providing four threads. AMD may say what it likes about the benefits of compute cores, but benchmarks don't lie and this processor is not a particularly fast one. Unfortunately, as 60% of the CPU is taken up by the graphical side of things, the overall performance in applications is limited. This also explains why we achieved some pretty mediocre benchmarks, even though the 7670K clocks an average of 3.6GHz (at maximum) when it came to computational tasks. In fact, we left it to complete our 30GB archive test, but after taking 30 minutes to complete 49%, we decided it would be a better use of our time to stop the process and continue with other benchmarks.

The biggest problem here is the fact this is still a processor based on an almost five-year-old architecture. It's only 28nm. It has limited SATA 6Gbps support and continues to only support DDR3 up to 2,133MHz, even though it's the one platform that would probably benefit the most from those increased memory speeds.

LEFT BEHIND

The list goes on. Intel may only be upping performance by 10% every year or so, but most vitally, it's including chipset updates, too. This forces manufacturers to update their motherboards and, in turn, provide extra expansion, storage options and more modern features that are appealing.

In gaming terms, the situation isn't much better. Yes, you can run older titles at acceptable frame rates at 1080p (if 20–30fps is acceptable to you) using just the onboard GPU, but unless you're only playing simple games, you're not going to get much joy from it. For instance, in *Middle-earth: Shadow of Mordor*, it achieved an average frame rate of just 4fps at 1080p, while a relatively-affordable GeForce GTX 950 managed an average of 33fps.

AMD's A8-7670K can run simple games at palatable frame rates, and it's great for basic everyday computing tasks. The matching motherboards are easy on the bank balance, and you have the added benefit of low-power consumption to help keep that electricity bill down.

We understand this is an $175 processor and you shouldn't be expecting a great deal at this price point. But for compatibility, ease of use and performance, you'd do so much better to head elsewhere. That's the sad truth, and it's worrying for the future of AMD in the chip business.

Godavari, AMD's new APU platform, so far, lacks any substance. It's aimed at one demographic – people that will likely game on laptops – with most desktop users opting for dedicated GPUs. It's too limited, too expensive for what's on offer, and too basic to provide anything to any form of power user.

Please, AMD... we need Zen, and we need it soon.

Zak Storey

Verdict

Features	★★★½☆
Performance	★★☆☆☆
Value	★★★☆☆

It can cope with basic computing and some simple gaming, but this chip is relatively dear for what it is.

★★★☆☆

HO! HO! HO!

Gear up your PC with OCZ SSDs this Year!

Upgrade to a OCZ SSD and unlock the potential of your notebook or desktop system

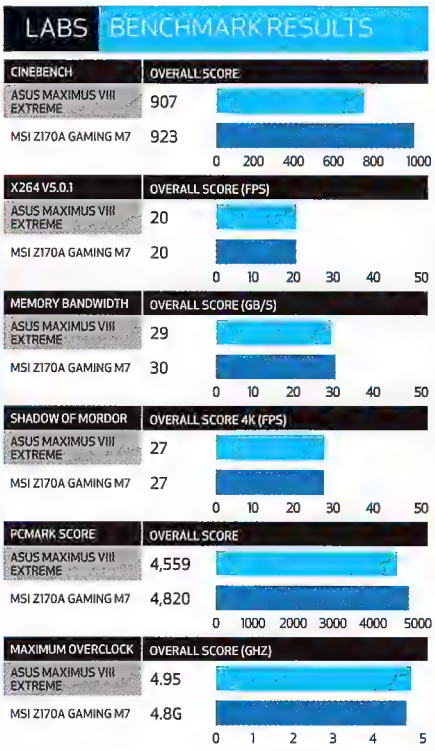
	Trion 100	ARC 100	Vertex 460A	Radeon R7	Vector 180	RevoDrive 350
CUSTOMER BASE	Entry-level Users	Entry-level Users	Mainstream	Gamers	Enthusiasts	Power Users
MAXIMUM PERFORMANCE	550 MB/s 90,000 IOPS	490 MB/s 80,000 IOPS	545 MB/s 95,000 IOPS	550 MB/s 100,000 IOPS	550 MB/s 100,000 IOPS	1800 MB/s 140,000 IOPS
ENDURANCE	27GB / day	20GB / day	20GB / day	30GB / day	50GB / day	50GB / day
WARRANTY	3 Years ShieldPlus	3 Years ShieldPlus	3 Years ShieldPlus	4 Years ShieldPlus	5 Years ShieldPlus	3 Years
BUNDLED ACCESSORIES	N/A	N/A	Cloning Software Desktop Adaptor	Cloning Software Desktop Adaptor	Cloning Software Desktop Adaptor	N/A

Merry Christmas and Enjoy Your Holiday!

OCZ STORAGE SOLUTIONS | A Toshiba Group Company

CENTRE COM centrecom.com.au | COMPUTER ALLIANCE computeralliance.com.au | computeronline.com.au | CPL Computers & Parts Ltd cplonline.com.au | MSY msy.com.au | mwave.com.au mwave.com.au | TechBuy techbuy.com.au | Umart Online umart.com.au

$499 | WWW.ASUS.COM/AU


LABS BENCHMARK RESULTS
CINEBENCH
OVERALL SCORE
ASUS MAXIMUS VIII EXTREME 907
MSI Z170A GAMING M7 923
0 200 400 600 800 1000
X264 V5.0.1
OVERALL SCORE (FPS)
ASUS MAXIMUS VIII EXTREME 20
MSI Z170A GAMING M7 20
0 10 20 30 40 50
MEMORY BANDWIDTH
OVERALL SCORE (GB/S)
ASUS MAXIMUS VIII EXTREME 29
MSI Z170A GAMING M7 30
0 10 20 30 40 50
SHADOW OF MORDOR
OVERALL SCORE 4K (FPS)
ASUS MAXIMUS VIII EXTREME 27
MSI Z170A GAMING M7 27
0 10 20 30 40 50
PCMARK SCORE
OVERALL SCORE
ASUS MAXIMUS VIII EXTREME 4,559
MSI Z170A GAMING M7 4,820
0 1000 2000 3000 4000 5000
MAXIMUM OVERCLOCK
OVERALL SCORE (GHZ)
ASUS MAXIMUS VIII EXTREME 4.95
MSI Z170A GAMING M7 4.8G
0 1 2 3 4 5

ASUS Maximus VIII Extreme

An extreme budget for an extreme board.

Let's be clear here. We understand that not everyone is into overclocking. However, for those who are looking for the absolute pinnacle of Skylake mobos, those who want the very best overclocking potential, regardless of cost, the ASUS Maximus Extreme series should be your first port of call.

When we test products – motherboards in particular – we have one specific benchmark that they all need to hit. And more often than not, we are limited by one common problem: the silicon lottery. Before this, we believed that our Intel Core i7-6700K was limited to 4.8GHz, and no matter what we tried, messing around with every setting and voltage under the sun, we could never surpass that. Even ASUS's RoG Maximus VIII Hero failed to go beyond 4.8GHz. At this point, you can probably guess what happened next. With just a few small tweaks – one to the ratio, and one changing the TPU setting in ASUS's very fluid UEFI BIOS – we managed to grab ourselves a stable 4.9GHz on top of successfully completing a full round of benchmarks on Cinebench R15.

Rather worryingly, this wasn't the scariest part of our experience with the Maximus VIII Extreme's overclocking abilities. After enabling ASUS's 5-Way Optimization software in AI Suite, it managed to overclock itself to 4.85GHz with relative ease. This means we're one step closer to Skynet. After all, if machines can overclock themselves, what's stopping their inevitable rise to power and our mutual annihilation?

It seems as though the Extreme wasn't entirely finished there either, as it wasn't the silicon preventing an even higher overclock, but the chip's temperature. There's almost no doubt that, if we had a more powerful cooling solution, our little Skylake CPU could hit that glorious 5GHz frequency with no problems. It's a shame that the NZXT Kraken X61 just couldn't quite hit the mark when it came to managing those CPU-punishing temperatures.

To be fair, this is a $500 motherboard, so you'd expect it to perform well. But if you're looking for something extra, the Maximus Extreme has oodles of other features to satisfy your PC gaming appetite. In addition to the plethora of microfine alloy chokes, 10K black metallic capacitors, and fancy MOSFET solutions, the Extreme comes with the same audio solution as found on the Maximus Hero. Of course, you still get everything AI Suite has to muster, and on top of that, you're graced with wireless AC and Intel's network traffic management. There's also an overclocking panel, a plethora of temperature monitoring points and even a fan controller expansion card included in the rather large box.

If overclocking isn't a priority, but you're a gamer who wants to stick with ASUS, grab yourself a Maximus VIII Hero. If you want something smaller (again presuming you want to stay with ASUS), the Gene or the Impact is probably going to be your jam. If you're not really a gamer but rely on solid dependability, you might want to take a look at the TUF Sabertooth lineup instead.

But for that minority of focused overclockers, this is as good as it gets.

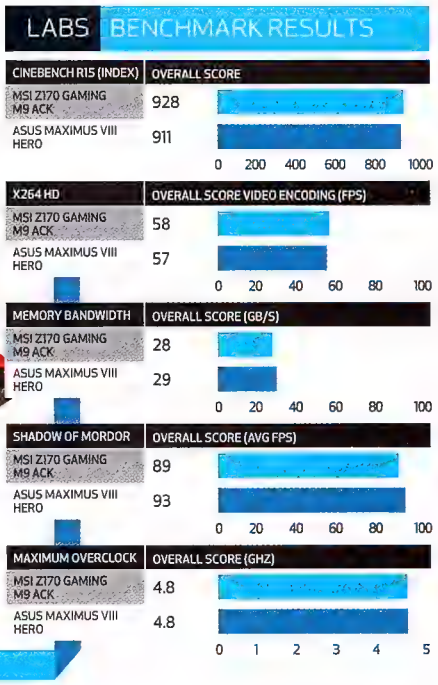
Zak Storey

Verdict

Features	★★★★½
Performance	★★★★½
Value	★★★★

Great overclocker; looks great; RGB lighting; 802.11ac; quality auto-overclocking; front bay panel.

★★★★½



INTEL Z170 MOTHERBOARD

$639 | AU.MSI.COM

MSI Z170A Gaming M9 ACK

A fantastic feature set at a phenomenal price.

MSI's Z170A Gaming series has impressed us before. It's a solid lineup, boasting a variety of feature-rich gaming boards at a fairly sensible range of prices. The M9 ACK sits at the top end of that spectrum at $639, so does it warrant such a high price tag?

Let's start with the M9's biggest selling point – its audio. It features multiple headphone amplifiers, a high-quality audio processor and insane audio capacitors, rounded off with a nice chunk of high-spec EMI shielding. The sound quality is beautiful. If your headphones are too quiet, this board will quickly jump to the rescue. On top of that, MSI has collaborated with Nahimic to provide an audio-enhancing software suite, similar to THX's now long-antiquated Crystallizer software, except a lot better. Honestly, it isn't easy to get across how impressive this audio solution is, so we'll sum it up this way instead: unless you have an external DAC, your audio is terrible in comparison.

This isn't the only area where the M9 shines. On top of all of this audio wizardry, MSI has an incredibly well thought-out network subsystem. Partnering with Killer, Micro Star International has developed software that utilises both 802.11ac and traditional Ethernet. What this does is successfully prioritise application bandwidth effectively between the two data streams, ensuring your games are transmitted via Ethernet, and your VoIP, web pages and other less important applications are sent over wireless.

Admittedly, this does feel like a solution to a problem that doesn't exist. Even Killer's advertising for its shield tech states that it has a 0.2 millisecond edge over its competitor. But we'd be surprised if you ever noticed that. You won't, it's not a thing. That's 1/5,000 of a second advantage over the non-Killer users for latency.

Taking a leaf from the ASUS Maximus Formula, the M9 also features integrated water-cooling connectors for the voltage regulators. They feature G1/4 threads, which means you can use any fitting you like to cool your VRMs. The flexibility on this one is great – props to MSI for ensuring that the water-cooling enthusiasts are taken care of.

The big downside is the price. At $639, it needs to deliver on all fronts, and there's a small problem with performance – you don't get as much overclocking potential as you would from the more affordable Z170A Gaming M7.

You need to consider whether the additional features are worth the drop in overall overclock stability. You're also limited to two-way SLI or three-way CrossFire, in contrast to the vast majority of competitor boards at this price point that support three-way Nvidia graphics solutions and quad CrossFire setups.

This M9 doesn't come without flaws, but the integrated audio solution is second to none. Although the Killer networking solution won't see much advantage over Gigabit Ethernet sockets, it's a fantastic innovation in an area that's otherwise not seen a great deal of advancement beyond 802.11ac recently. If you've got the money, and really want the best audio you can get outside of an external DAC setup, and a stunning motherboard to boot, the MSI Z170 Gaming M9 ACK is the board for you.

Zak Storey

Verdict

Features	★★★★½
Performance	★★★★
Value	★★★½

Fantastic audio solution; water-cooling support; stunning heatsinks; strong UEFI experience.

★★★★☆

apc RECOMMENDS

27-INCH MONITOR

$570 | WWW.BENQ.COM.AU

BenQ GW2765HT

This 27-inch all-rounder will take some beating.

Choice is a fine thing. But in this modern age of economic plenty, it can also be paralysing. Shopping for a new PC monitor? Right now, you can choose from all manner of screen resolutions up to 4K. You can even go beyond that, with 5K screens of late. Or how about a monitor with an ultra-wide panel? Or a curved surface? Or support for stereoscopic 3D? While you're at it, what about high refresh of 120Hz or more? And don't forget you'll want that refresh perfectly synched with your GPU's output.

Once you've sorted all that out, you'll also need to choose a panel type – IPS, TN or even VA. Also, have you decided whether you need a fully adjustable stand? You get the point. It's almost too much choice. And even if you can afford to take your pick from everything above, there isn't a monitor currently available that combines the best bits of everything.

Which brings us to the new BenQ GW2765HT. It's not exactly cutting-edge in any area. But it might just be about as good as it gets in the real world right now.

4K resolutions and beyond might be seriously seductive, but you'll struggle to drive them properly in games. Too many pixels, you see. The BenQ has 2,560 by 1,440 pixels. Enough for decent desktop screen real estate, and great in-game detail, but not so much that it overwhelms your GPU. Likewise, at 27 inches, it'll satisfy most people's need for sheer scale of image. It also has a fully adjustable stand.

Oh, and here's the kicker – it has a proper IPS LCD panel. None of your poverty-spec TN stuff going on here. All for well under $400, and from a big brand, as opposed to some obscure Korean thing sourced from a sketchy eBay dealer. Nice.

What you don't get is high refresh or frame synching technology. That's a pity for games, especially the high refresh bit. But the fact is, IPS 27-inchers with high refresh support are both rare and very pricey. Something has to give at this price point.

If you can get over that, what you'll find is a delightful panel. Fire it up and you're instantly in no doubt that this is a quality IPS item. The colours are both super vibrant and immediately accurate.

It's nicely calibrated out of the box, too. Both the black and white scales are pretty much faultless. The anti-glare coating is nice and smooth, too. None of that old-school twinkle. Speaking of traditional IPS downsides that have apparently disappeared, you'll struggle to pick up on any of that annoying IPS glow in dark tones. The latest IPS panels have dialled it out.

As a gaming panel, it's not bad, either. There are four levels of pixel response available from the overdrive menu. You can switch overdrive off, or choose from one of three enabled settings. The middle setting jazzes up the response without introducing inverse ghosting ugliness.

If you insist on teasing out some shortcomings, the backlight is very slightly yellow, and the integrated speakers are feeble and tinny. The chassis and stand are pretty plain looking, too.

Overall, then, it's a very nice package for the price. If you've seen high refresh and simply cannot live without it, fair enough. For everyone else, this BenQ will take some beating.

■ Jeremy Laird

Verdict

Features	★★★★½
Performance	★★★★½
Value	★★★★½

Doesn't have the latest gaming tech, but this is a lovely 27-inch IPS panel that's well calibrated and fully adjustable.

★★★★½

NAS BOX

$390 | WWW.QNAP.COM

QNAP TS-231+

QNAP's latest two-bay NAS offers a feature-rich and easy-to-use OS.

QNAP's TS-231+ is aimed at the SOHO market and is an upgraded version of the company's TS-231 two-bay NAS. This device has a faster processor, twice the memory, and SSD cache support, which is something of a surprise in a NAS in this segment. It looks identical to the TS-231, with the same dual Ethernet LAN ports (which support link aggregation) and three USB 3.0 ports, but surprisingly, the TS-231+ does away with the eSATA port found on the TS-231.

The CPU is an Annapurna Labs Cortex A15 dual-core chip, with a clock speed of 1.4GHz – 200MHz faster than the A9 in the TS-231. This is backed by 1GB of DDR3 RAM, and that's your lot, as the memory is soldered to the mainboard. Performance is good, with strong read/write figures in the ATTO benchmarks, though it's a bit slow reading 4K files, as shown by the CrystalDiskMark scores. However, its write performance dealing with these small files is strong in both RAID arrays.

This is another front-loading NAS. The drive doors can't be locked, though, and the hot-swappable drive trays are not tool-free, needing screws to fix in the 3.5-inch or 2.5-inch drives it supports (including SSDs). The unit supports up to 8TB drives – a list of compatible drives is on the QNAP website. The front USB 3.0 port has a one-touch copy button, enabling everything on the plugged-in drive to be copied to the NAS automatically, without powering up a PC.

If there's one thing that all the NAS units we've tested recently share, it's ease of setup, and the TS-231+ doesn't spoil that impression, as it takes hardly any time to get up and running, and QNAP's QTS (v4.2) OS is another impressive icon-rich UI.

It not only looks good, it's got some really useful features built in, as well. Storage Manager is a powerful tool for volume management, offering storage pooling using multiple RAID groups, thin provisioning including reclamation of any free space, iSCSI, and snapshot support to provide data protection. For further data protection, volumes and folders can be encrypted, and the TS-231+ supports AES-256 encryption of external drives. Also provided is the ClamAV antivirus toolkit.

File Station is a powerful file management tool that supports CIFS, FTP and WebDAV. Once the Connect to Cloud Drive app has been installed, there is a choice of six cloud-based storage services – Google Drive, Dropbox, Microsoft's OneDrive, Box, Amazon Cloud Drive and Yandex Disk. File Station also supports smart zonal streaming to a DLNA compatible TV, media player, Apple TV or Chromecast.

For backing up, there's a comprehensive list of local and remote options, plus a large number of cloud options. Folders can be synchronised between the TS-231+ and the cloud via Microsoft OneDrive for Business, Microsoft Office for Dropbox, Amazon Cloud and Google Drive for Work. Download Station has a built-in BitTorrent search engine, and any downloads continue to completion if the computer is shut down.

To customise your TS-231+, there's a whole host of downloadable apps available. The list is long enough to give even competitor Asustor's download store a run for its money – and there aren't many that can do that.

Verdict

Features	★★★★½
Performance	★★★½
Value	★★★

A very feature-rich OS, but the memory can't be upgraded and it's a little more costly than some competitors.

★★★½

BLACKBOOK 13 ZERO

COMING SOON

VENOMCOMPUTERS.COM.AU

BROADBAND ROUTER

$229 | WWW.SYNOLOGY.COM

Synology RT1900ac

A NAS company releases its first router... and surprises us with its flexibility and software features.

While many unconventional brands have tried to gain a toe-hold in the broadband router market over the last half decade, only one or two have really managed to stick it out. We're hoping Synology is another name we can add to the list. Better known for its network-attached storage boxes, Synology is looking to bring over the same software smarts that have made its NAS devices some of APC's favourites.

Specs-wise, the new RT1900ac is respectable but nothing particularly cutting edge. It's got dual-band 2.4/5GHz Wi-Fi (at 600Mbps and 1,300Mbps, respectively) and is powered by a mid-range dual-core 1GHz Broadcom BCM58622 processor with 256MB of memory. However, the router stands out not on specs, but on smarts. Running an OS called Synology Router Manager (or SRM), configuring the RT1900ac is done the same way as most others – go to the device's IP address (such as 192.168.1.1) in your browser and log in with your admin username and password. Rather than simple text-based menus and drop-down boxes, SRM's interface apes a standalone OS, giving you a virtual desktop with app icons and 'programs' that launch inside their own windows, which you can drag around, resize and minimise or maximise.

Moreover, SRM is overflowing with features and options. Its bandwidth management settings are some of the most advanced we've seen, allowing you to monitor usage in real time, based on either device or application, or restrict a single device's upload and download speed with hard KB/s limits. There are in-depth parental controls and you can easily set schedules to turn off access for specific devices at certain times of day – great if you have kids and don't want them up all night on the net. You can configure lots of little things to levels of detail not usually seen, like turning the status LEDs off at night-time, and there's a comprehensive built-in manual that reveals what everything does in plain English. Synology even offers well-made admin mobile apps for iOS and Android.

Beyond the built-in tools, you can add more functions by installing modules downloaded from Synology. Adding Download Station, for example, lets you plug in a USB storage device and download things directly with the router, with lots of options to get it set up.

The only worry we have with the RT1900ac is that its performance was mixed. While it was up with the best at close range (managing read and write speeds of 57.7 and 68.3MB/s, respectively), at medium to long range, it dropped to more sedate speeds (30MB/s and 20MB/s), which puts it below average and about 10–15MB/s behind the best in these areas.

What's not in dispute is that the RT1900ac offers features and a level of depth you won't find elsewhere. Its SRM interface often makes managing and monitoring your network easier than on basically any other router we've tested. You may need to do a little learning to make use of some of those features, but it does a good job of explaining what all the bells and whistles do. If you can deal with just average performance, this is an amazing device from a features standpoint, and one that's quite affordable, too.

Dan Gardiner

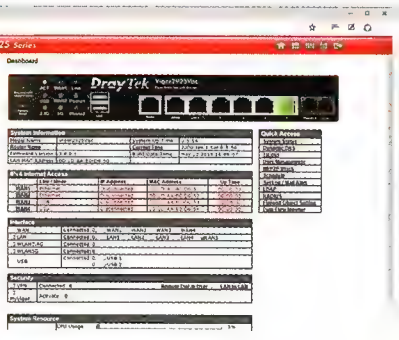
Verdict

Features	★★★★½
Performance	★★★½
Value	★★★★

Stands out thanks to an amazing OS, but long-distance wireless performance could be better.

★★★★

apc RECOMMENDS



The DrayTek's admin interface is not for the uninitiated.

ADSL ROUTER

$500 | WWW.DRAYTEK.COM.AU

DrayTek Vigor2925Vac Dual-WAN Security Router

A router that boasts a lot of features for a reasonable price.

DrayTek's new Vigor2925Vac occupies an unusual space in the router spectrum, as it's suitable for both high-end consumers and small businesses.

The ports-in-front design, VPN support, multiple SSIDs, load balancing, LAN segmentation, sophisticated application filters and monitoring, complex user management and firewall settings are all potent business abilities, but there are nods to lower-end use, like a number of built-in wizards for setup, as well as VoIP support. But this is not for people who don't know much about networking and plan on managing their own router. Even with the wizards, the configuration is scary and there's very little hand-holding. It's a tool to be managed by very experienced users, or to be managed remotely by a system administrator.

In terms of physical ports, it has five gigabit Ethernet LAN ports and two gigabit WAN ports (with failover and load balancing). It also has a pair of USB 2.0 ports, into which can be plugged storage devices or a 3G/LTE modem; the latter can be integrated into the load-balancing schema. There's two VoIP ports – one for the handsets (FXS) and one for PSTN failover (FXO). Finally, there's the 802.11ac wireless support, hitting 1,300Mbps at peak – when we tested it, it managed 26.6MB/s at 15m through two plaster walls, which was a solid result (as a comparison, a Netgear D6300 hit 27.7MB/s).

It's the VoIP option that confused us. VoIP is a rare beast these days, with only a small handful of routers still supporting it (which is unsurprising, since many providers now offer regular PSTN calls at rates comparable to VoIP calls). What makes this more unusual is that this is not a DSL modem router – it's a broadband router for small businesses and satellite offices. For larger companies, with IP phones routing through a central server, this doesn't seem all that useful, but for companies that don't have that kind of infrastructure, this could be a long-term money saver. Unfortunately, the VoIP options are not that comprehensive, though the security setup is very solid.

When it comes to the VPN support, you can set it up for both LAN to LAN (client) connectivity, as well as a VPN server with up to 50 IPSec tunnels. We had it connected as a client to a commercial VPN service in a matter of minutes, using L2TP/IPSec. However, the VPN client service wizard did not support OpenVPN (SSL), which is now the default option for many VPN services. The router does support SSL as a server, but it's switched off by default. It's one of the router's numerous rough edges.

But there's a lot to like about this router. It's packed with features and options, and offers a whole lot for a reasonable price for a business router. However, the management is disjointed, occasionally confusing and poorly explained. But if you're confident of your network bonafides, it's a very capable router, with all the tools that most small and medium businesses will need.

Nathan Taylor

Verdict

Features	★★★★
Performance	★★★★
Value	★★★★

A few rough edges, but it boasts an awful lot of features for an entry-level business router.

★★★★½

apc RECOMMENDS

POWERLINE ETHERNET KIT

$169 | WWW.DLINK.COM.AU

D-Link DHP-701AV

A speedy 240-volt Ethernet connection.

This is one of the faster Ethernet-over-power (EOP) kits we've tested, pushing up to 35MB of data per second (or 260Mbps) around the network – slightly more than the average USB 2.0 connection and doubling the speed of D-Link's earlier DHP-601AV mode, reviewed in our sister-mag TechLife's October issue (p. 61). When you consider that the DHP-701AV's retail price is only $50 more than the older DHP-601AV, it might be worth the premium.

If you're looking to set up a home media server or you want to back up your PC through the network (everyone with a NAS should), that's where you'll benefit most from these higher speeds. Even with the NBN, most homes won't have the kind of internet connection required to max out these speeds. This kit would also be worth considering if you need to set up stable and reliable connections at far-flung ends of the house, where the Wi-Fi doesn't reach or is too flaky to be relied upon.

As far as the general size and get-in-the-wayness goes, EOP adapters often have the annoying tendency to eclipse both sockets in a power outlet and/or to protrude far enough to limit them from use in sockets that are close to wall-corners or the floor. That's mostly the case with these too – you'll have to be prepared to sacrifice the double-outlet with the DHP-701AV, as there's no socket passthrough, and each plug is too large to share. At least D-Link has inverted the prongs so that each plug actually 'faces' upwards, meaning you can use them in sockets flush with the floor.

Joel Burgess

Verdict

This power line kit offers fast speeds and respectable value, but the plugs are physically a bit bulky.

★★★★☆

PAYAM Data Recovery

AUSTRALIA'S #1 DATA RECOVERY COMPANY

OFFICIAL WESTERN DIGITAL DATA RECOVERY PARTNER IN AUSTRALIA AND NEW ZEALAND

THE ONLY AUTHORISED SEAGATE DATA RECOVERY SERVICE PROVIDER IN AUSTRALIA AND NEW ZEALAND

EXPERT DATA RECOVERY FROM Damaged Hard Disk Drives, SSD, RAID, NAS, Mobile Phones, USB Flash Drives and Memory Cards.

Are you an IT Professional?
Join our Free Partnership Program today.
www.payam.com.au

See our CLASS-100 CLEAN ROOM at www.payam.com.au

Data Rerovery Labs in Sydney, Melbourne, Brisbane, Perth, Adelaide and Auckland (New Zealand)

1300 328 273 help@payam.com.au

www.payam.com.au

PC GAMEPAD

US$50, AU PRICE TBC | STORE.STEAMPOWERED.COM

Steam Controller

How I learned to stop complaining and appreciate the controller.

Word on the street is that the Steam Machines were delayed because the Steam Controllers weren't ready. After using the device for several days, we think it has tremendous potential, but we think Valve took it out of the steamer a little too early.

It's still weird. It has two circular touchpads on the front, a left joystick and four Xbox-style face buttons pushed down toward the centre-bottom. Some are dismayed by the smaller buttons and their placement but what was bothersome at first for us were the touchpads, which offer varying levels of haptic feedback. The mostly plastic Steam Controller has convex sides, which lead your thumbs to the centre of these oddities. They have a steep learning curve and will probably take you hours to get comfortable with. If you're willing to put in the time, however, you might be able to tap into the controller's true potential. On top are four shoulder buttons and there are two customisable paddle buttons on the back, which are a welcome addition. Front and centre of the controller are buttons for start, select and Steam Big Picture mode. The SBP button is also the gateway to configuration, enabling you to force-quit games.

Because it was designed to be backwards compatible with the entire library of Steam games, Valve is relying heavily on the community to make custom game presets. The highest-rated community-made preset will be the default control scheme for each game. While this sounds great in theory, at the time of writing, many games either lacked presets or the ones they had were rubbish. In addition, the touchpads can act differently from preset to preset. The trackpad is sometimes programmed to emulate a joystick, trackpad, mouse or trackball.

Luckily, there are generic presets that you can choose from to emulate a standard Xbox controller or mouse/keyboard combo, but these presets don't always allow you to navigate game menus.

To be fair, most of our testing was done before the community at large got their hands on the controller, but as of now, Valve doesn't even have presets for its own games. *Team Fortress 2* handles well using the default, generic controller input, but it doesn't have buttons to switch characters or classes. The Rockstar-supplied *GTA V* is near unusable when it comes to shooting. Thankfully, you can tweak pretty much everything. The modding community will definitely get a kick out of it.

Once you get the controller working, it really flies. Some are of the opinion that Valve is trying to fix a problem that doesn't exist, but we don't subscribe to that notion. Trying to use an Xbox controller against a keyboard/mouse user is like bringing a knife to a gunfight. While the Steam Controller will never replace the keyboard/mouse combo in our eyes, it at least closes the gap.

We imagine that the Steam Controller will shine once more of the community gets their hands on it, but we unfortunately can't review a device based on potential. As it currently stands, we suggest holding off until more community presets are made and the bugs are steamed out... which they hopefully will be by the time we see an Australian launch.

Jimmy Thang

Verdict

Features	★★★★
Performance	★★★½
Value	★★★★

Easier to get headshots than with an Xbox controller; comfortable to hold; touchpad support for mouse menus.

★★★½

GAME STREAMING BOX

US$50, AU PRICE TBC | STORE.STEAMPOWERED.COM

Steam Link

Low-cost PC game streaming, but wireless connections need not apply.

In case you already have a capable gaming PC, and don't want to pony up cash for an expensive Steam Machine for your living room, Valve has an affordable game-streaming device it would like to sell you. The Steam Link its a passport-sized peripheral that allows you to mirror games from your desktop PC using Steam's In-Home Streaming feature.

In terms of tech specs, the Steam Link supports HDMI for a 1080p/60Hz output to your HDTV. The little box measures 123 x 90 x 14.7mm, and other connections include power, 100Mbps Ethernet, and three USB ports. We'd have preferred four USB ports for more wired controllers, but the Steam Link does enable you to connect up to four Steam Controllers without need for any USB dongles, and the device also plays nicely with USB hubs. Underneath the hood, the Link supports Bluetooth 4.0 and wireless 802.11ac, along with your standard b/g/n variants. Setting up the Steam Link is easy. While it works best with the separate Steam Controller (see page 30), we've also been able to hook up Xbox 360 and Xbox One controllers, and even a keyboard and mouse to it.

The Link shouldn't be used wirelessly, in our experience. Anything under 50 milliseconds of latency is fine, and while the Link was able to stay under that for most of our wireless time, the compression, audio drop-offs and lag spikes just killed it, even when we were just a dozen feet away from our ASUS RT-N66U router in the next room.

The lag would shoot up to over 400 milliseconds on occasion. We tried playing around with all the latency settings, but nothing we did resolved the issue. The experience is better when you have the device right next to the router, but even then, we experienced weird issues where it kicked us out to our PC's desktop menu.

When we tried to open Steam Big Picture mode (again using the Steam Controller's mouse emulation), it launched us back into the game that was already in progress, but shifted commands from our controller to our desktop's keyboard. To be fair, even Valve says on its product page that a "wired network is strongly recommended", but it should have perhaps added an external antenna to extend the Link's range.

When you go down the wired route, the situation improves dramatically. We experienced latency around 20 milliseconds, which is perfectly playable. We also set streaming quality to Beautiful, and compression wasn't an issue either.

Because it's streaming from your gaming PC, it does bring some unwanted features along with it. We had an antivirus update prompt pop up on our desktop and this caused the Steam Link to freeze, and we had to go back to our computer to close the offending message. Also, expect to hear things such as chat notifications or other sounds that your PC produces. Plus, games that load in Windowed mode look pretty weird. Sometimes, you'll see your Windows taskbar icons below.

The Steam Link is supposed to deliver an elegant and seamless streaming experience, but we still see a lot of dirty laundry. At US$50, we only recommend it for those who can use the wired option. Even then, don't expect a perfect experience yet.

Australian pricing and release are still TBC, too.

■ Jimmy Thang

Verdict

Features	★★★½
Performance	★★★½
Value	★★★★

Affordable; can connect multiple controllers to it; bumpy ride.

★★★½

$90 | WWW.FOSCAMAUSTRALIA.COM.AU

Foscam C1

A wireless networked security cam that should probably eat a few more carrots.

The Foscam C1 is a discreet security camera that manages to pack an impressive number of features into an affordable DIY solution. Though this device is supported by plastic mounting hinges that feel a little flimsy, it doesn't hinder the device's movement.

The C1 has a fisheye-shaped lens, which gives it 115° of horizontal vision and a generous vertical field of view that makes the picture area fractionally bigger than some other network cameras we've tested.

Foscam offers a standard 1,280 x 720-pixel video but the 1MP camera delivers above-average picture quality and was noticeably better at capturing motion than a number of more expensive alternatives, including Belkin's Netcam HD+, which we also tested for this review. The C1's motion capture does diminish somewhat when it's also recording video (rather than streaming it), but even then, in daylight, the camera still performs better than most.

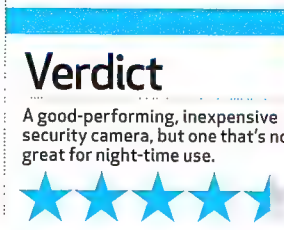
The motion sensor is good, has a number of useful sensitivity and parameter settings, and allows you to be notified directly through a phone alert if motion is detected, rather than spamming you with emails.

You can't subscribe to Foscam's cloud-based recording service in Australia yet (which lets you save videos directly online), but the C1 does have a microSD card slot that will be able to store footage.

The night vision isn't very good, however. Videos are low on detail, making it difficult to make things out. Provided you're using it in well-lit areas though, the C1 punches well above its price point. ■ Joel Burgess

Verdict

A good-performing, inexpensive security camera, but one that's not great for night-time use.



$100 | WWW.GSKILL.COM

G.Skill RipJaws MX780

The memory and SSD-maker breaks into gaming peripherals.

With great gaming mice like Razer's DeathAdder Chroma going for as little as $65, it can be hard for a higher-end model to justify its asking price.

With an Avago 8,200dpi laser sensor and Omron switches under its eight programmable buttons, the MX780 certainly ticks the necessary specs boxes, and adds customisability to that list, with side-grips that you can have with or without a swooping wing (to support your thumb) and a separated palm rest that can be raised or lowered for comfort. While every gaming mouse worth its salt now has customisable RGB lighting, the MX780 goes a little further, with six separate LEDs that can be set to its own colour and style.

Its confronting visuals let you set it up for best-fit whether you're left of right handed. Raising the palm rest does increase the length of the mouse and the MX780 is best suited for those with bigger hands and longer fingers. Those with short digits (like a certain reviewer) may find the mouse wheel a little harder to reach. Speaking of which, its rubberised silicon finish makes it smooth, which, when combined with ratcheted movement, means it can get slippery. But the smooth matte-finish of the buttons and palm rest is quite comfy and a couple of 4.5g insertable weights can take it from 111g to 120g.

G.Skill's customisation software lets you set profiles for both buttons and lighting, create detailed macros, launch programs, and a whole lot more. But for those who just need the basics, there are better and cheaper options. ■ Dan Gardiner

Verdict

Nice for those with longer hands, but doesn't really stand out from the crowd enough to justify its price.

GAMING KEYBOARD

$250 | WWW.GSKILL.COM

G.Skill RipJaws KM780

For those times when you need to have all the things.

Loads of tenkeyless keyboards have landed on my desk lately, so it was almost a novelty to tear the packaging from this full-sized (and featured) beast.

Coming in at a whopping 518 x 228mm, the Ripjaws KM780 takes up a heap of precious desk real estate. It manages to pack in a heap of features but, at this size, you really need to weigh up how essential they are to your gaming life, especially at this higher end price point.

As well as the Home and numpad banks standard with full-size keyboards, the KM780 features six macroable keys down the left side, full media controls – plus LED volume display – along the top, and onboard memory for up to three setup profiles. One neat function is a button that lets you set timers – to track skill cooldowns for example – that gives you a visual alert when done. Rounding out the features is Windows Lock, a single USB port and audio/mic passthrough.

Unlike the CM QuickFire we looked at a couple of months ago, you're going to have to dig through G.Skill's software to manage all its functions. It's a pain not to have instant record for macros and key lighting, but it's a fairly straightforward resource and not a drain on the system.

Also included in the package (now almost standard) is a keycap tool, plus an additonal set of coloured caps for the WASD gaming cluster. Sadly, the texture on these is slippery and it feels awful to the touch.

Our review unit was fitted with Cherry Brown switches, but the KM780 is also avalable with Red for those who prefer something a little more responsive, and clacky.

■ Troy Coleman

Verdict

An expensive mechanical keyboard with loads of "gaming centric" features in a gigantic frame.

★★★☆☆

GAMING KEYBOARD

$139 | WWW.RAZERZONE.COM

Razer BlackWidow Chroma TE

The best keyswitch known to man... probably. Maybe.

We've looked at earlier iterations of Razer's in-house mechanical key switches before and been less than impressed. We're not sure if this is a later generation, but at least in the Chroma TE, they work really well. You might even say the switches... really *clicked* with this reviewer.

This isn't the quietest key on the market, as it still retains the signature click of Cherry's. But, honestly, the pleasure your fingers are going to feel from these little things is second to none. It has a higher actuation point when compared to Cherry's world-famous red switch, yet it's still more responsive than the blue while retaining that tactile click. This gives it a classy feel and combines it with a beautiful noise.

Razer provides four different editions of the BlackWidow Chroma lineup – the TE edition being a chopped-down, tenkeyless variant which loses out on both USB and audio passthroughs, as well as an additional five macro keys. (Although, honestly, how often do you use those things?)

The Chroma TE follows the current trend for lighting individual key switch with 16.8 million colours available and a wide variety of modes from reactive, to ripples and waves, colour cycling, breathing and the traditional static.

As far as negatives go, there's not a great deal that can be said against the Chroma TE; it all comes down to personal preference and how highly you rate additional features, such as macro keys, USB and audio passthrough or a discreet bank of Function keys.

If the answer is "not at all", then you'll be more than happy with the finish, feel and build quality here.

■ Zak Storey

Verdict

Affordable, highly responsive compact board with great LED lighting and good software UI.

★★★★½

apc RECOMMENDS

GAMING HEADPHONES

$120 | WWW.ROCCAT.ORG

Roccat Aluma

Get these headphones in-ear, quick.

Though Roccat has developed an impressive reputation for its headphones, the Aluma sees the company enter virgin territory in the in-ear space. With its sights (sounds?) set on the mobile and PC gaming sector, the Aluma aims to provide a stylish, well-rounded audio experience in a portable package.

Though not everyone is a fan of in-ear headphones, the Aluma boasts a level of comfort that could make converts out of non-believers. This is due, in part, to Roccat's inclusion of ergonomic rubber eartips that come in three sizes, so everyone is likely to find a perfect fit for their ears. It sports a Tron-like cyan and black colour scheme that's attractive without drawing too much attention. Its flat, tangle-proof cables are also slick, and though it looks like a big rubber band at first glance, it actually feels quite durable. When it comes to sound quality, the Aluma delivers a clean, even sound that's neither bass-heavy or tinny. Though it performs admirably in the bass department for a pair of in-ear headphones, over-ear headphones are still recommended for a truly immersive experience. As a gaming headset, the Aluma handles voice chat quite well, though its omnidirectional microphone may pick up surrounding noise from time to time. While it might not surpass over-ear headphones as your go-to choice for PC and console gaming, its handy carry case and multiple adapters make the Aluma the perfect set of headphone to keep on you for all occasions.

Stephen Lambrechts

Verdict

Roccat Aluma is a great all-rounder for gamers looking for an in-ear audio solution.

★★★★½

GAMING HEADSET

$80 | WWW.PLANTRONICS.COM/AU

Plantronics GameCom P80

A decent, if unspectacular, wireless gaming headset.

If you're looking for an affordable alternative to the wireless headphones produced by field leaders Logitech, Turtle Beach and Razer, you could do a lot worse than the Plantronics GameCom P80. Sporting an attractive, subtle design and wireless functionality, the P80 delivers a decent soundscape for a stereo headset.

Though the headset performs satisfactorily, game audio is a little on the muddy side, with a lack of clarity that lets down its impressive bass. Setting it up, thankfully, is a cinch – insert the accompanying USB dongle into your PC or PS4, hold down the power button on your headset and it connects instantly. Though the P80 works great on PS4, the thickness of its dongle (which you really have to force between PS4's upper and lower sections) leads us to believe it was designed with PCs in mind. One of the unit's standout features is its solid microphone, which you can flick down to enable and flick back up to mute. It's not an in-line mic, though, so while your friends will hear you clearly, you'll have trouble hearing yourself over the in-game audio, which can be unpleasant. In terms of battery life, the P80 will last you an impressive 10 hours off a full charge. It's got a decent range, too, with audio remaining clear at a distance of up to 12 metres. Unfortunately, we found it to be slightly uncomfortable after around 30 minutes of gameplay. The P80 is decent for its price, but if you have some extra cash, you can do better.

Stephen Lambrechts

Verdict

An affordable wireless gaming headset that does the job, just not particularly well.

★★★½☆

SMARTPHONE

$399 | WWW.SONY.COM.AU

Sony Xperia M4 Aqua

Struggling to make a splash.

At first glance, you'd be forgiven for mistaking Sony's new midrange Xperia for one of its flagships. The company is so steadfastly sticking to its design ethos that all of its phones have started to look the same. But the M4 Aqua has gone for a plastic chassis, a subtle difference but one that tells you a lot about what you'll get. It's a step down from the best, but still a perfectly serviceable device.

On paper, that appeal does mostly hold up; there are some good upgrades from the $200–$300 Android models out there, such as the 5-inch IPS LCD (though it's still only 720p), 8GB of storage and a microSD-slot for adding up to 128GB more, 2GB of RAM, a 13MP camera (one of the better units at this midrange price) and even water and dust resistance to the same IP68-rating as its pricier Xperia siblings. The M4's USB charge port doesn't have a plastic cap, it's waterproof without it. You won't get top-end performance — despite an octa-core Snapdragon processor — or gaming capabilities, but they're certainly on-par for this price point. Its battery life is also very good, thanks in part to that midrange hardware, and it lasted a good 8–10 hours of screen time. More than enough for the average day.

For $50 more, the latter ups the screen res to 1080p, doubles the storage to 16GB and adds an extra gig of RAM (for 3GB total), things that improve day-to-day performance. But unless you need the waterproofing or can't stretch that $50, the Oppo R7 is probably the better choice.

■ Dan Gardiner

Verdict

Offers some unique features, but struggles agains the latest competition.

★★★½☆

SMARTPHONE

$999 | WWW.SONY.COM.AU

Sony Xperia Z5

Forget the sedated looks — Sony's new premium smartphone is a classy job from end to end.

Sony's latest flagship is the 5.2-inch Z5 — a reserved-looking phone but not a boring one, with a one-note colour scheme that extends from the frosted-glass rear to up and around the sides. You can opt for the gold, white or forest-green options if you want a bit of colour. Some might accuse the Z5 of not having any personality, but to us, the design understatement speaks volumes.

The volume controls have dropped down the side to nestle closer to the camera button, and the power button now has an integrated fingerprint sensor. On previous Xperias, the rubber-lined sealing caps that gave the devices their waterproofing had a tendency to break off due to repeated use, so it's good to see that the Z5's charge port no longer requires one and the SIM and microSD are mated into the one tray.

Look at the benchmark results and you'll see they're in the top tier. Compare it to the iPhone 6s or Samsung's Galaxy S6 and you'll see some stats are better (and worse) than others. The Z5 packs a decently sized 2,950mAh battery and runs the Snapdragon 810 processor, which has a history of overheating. However, Sony's lab techs have promised that shouldn't be an issue, and boast that the battery will last for two days — in low-power Stamina mode. Yet, the Z5 continues to impress. It's fast, responsive, and does a brilliant job as a multimedia device. That 23MP camera is also very smart, with impressive image stabilisation and the front-facing 5.1MP snapper will still capture a thousand likes.

■ Paul Taylor

Verdict

This Android true-believer is a sharp all-rounder that wil leave you smiling.

★★★★½

software

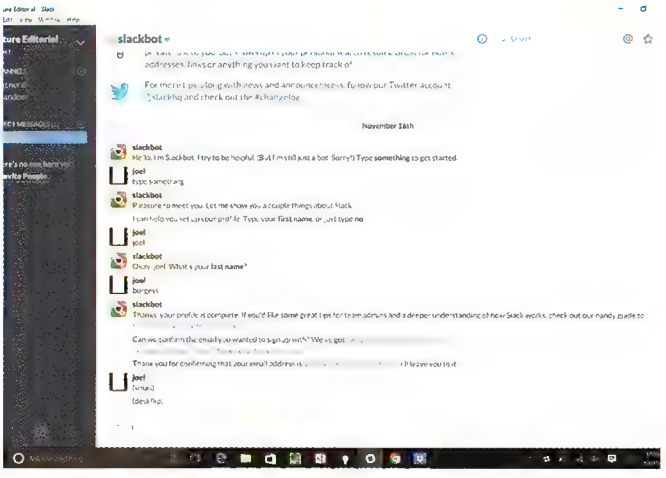
» APPS FOR ALL THE PLATFORMS

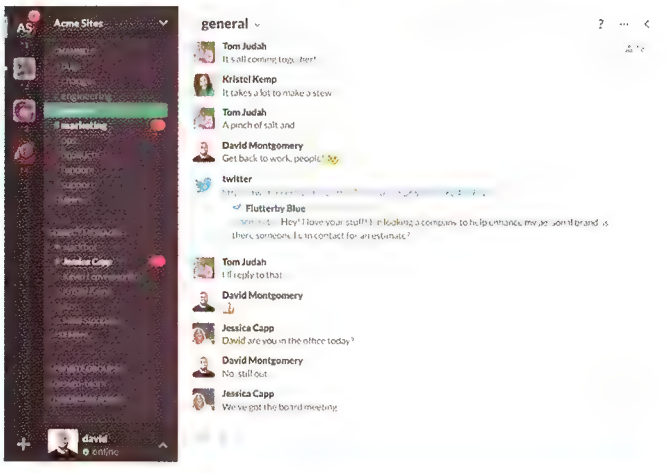
Windows SOFTWARE

Slack

The group-chat app that ain't slack.

FREE | WWW.SLACK.COM





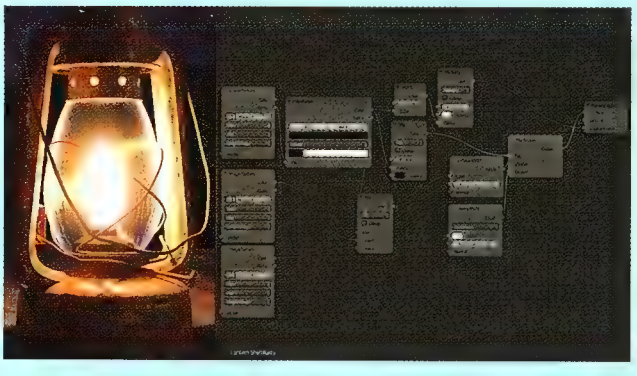
If you're looking to upgrade your instant-messaging chops from Facebook Messenger, the Aussie-made HipChat or the team-oriented collaboration tool Slack are the two big-name contenders in the group-chat space. Although both these apps largely target workplace use, they also offer generous free tiers (ostensibly to entice business subscriptions), which happen to make them awesome tools for friends or study groups to collaborate on projects or just chat online.

Slack was initially a by-product that emerged from the internal interactions of game-developer TinySpeck while working on the (now defunct) online game *Glitch*. The app has found a solid following in dev communities, as it caters to the needs of this specific type of team, although since becoming publically available a little more than two years ago, it's quickly found a much-broader audience, building a user base of over 1.1 million active daily users by mid 2015.

Slack and HipChat have a similar layout and break down the group or direct personal messages in a similar ways. They're also capable of handling a multitude of file formats and facilitate video calls in addition to IM, but there are a few subtle differences between the two. Slack is more visual than HipChat and includes more pre-configured emojis, profile pics and settings, such as letting you tweak the colour scheme. Slack recently pushed its Windows Phone app out of beta, too, which also puts it marginally ahead of HipChat in terms of accessibility. **Joel Burgess**

Blender v2.76

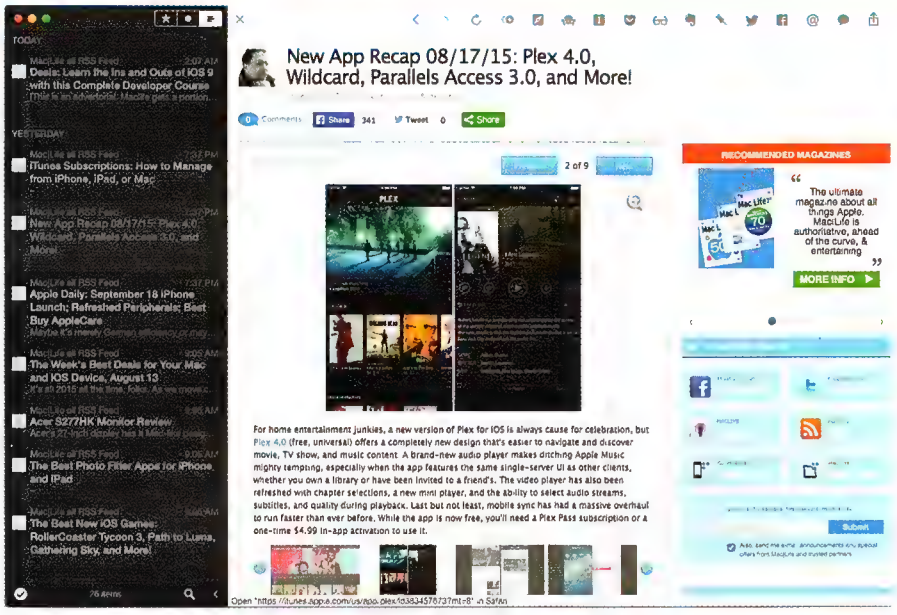
WWW.BLENDER.ORG | FREE



Blender is a great project that the open-source community has every reason to be proud of. It's a fully integrated 3D content creation suite that offers a broad range of essential tools — modelling, UV mapping, texturing, rigging and skinning, animation, simulations, scripting, rendering, compositing, VFX and game creation.

The interface is optimised for simultaneous use of mouse and keyboard, and Blender has an on screen target cursor that enables you to place objects in the 3D space. Once you have your target cursor positioned using your mouse, you can use keyboard shortcuts to place your object (lights and geometry etc). Rendering can be done with a quick flick of the F12 button. Of course, working with Blender for newcomers is a steep learning curve so it'll take time before you'll be able to do something more complex than, say, a ball on a plane.

However, for experienced users, Blender offers the very handy Interaction preset setup with predefined settings for people accustomed to 3D Max and Maya. The recent Blender 2.76 release enables the ability to do stunning things, such as photo-realistic HDR rendering with GPU acceleration, high-quality textures for lots of materials and it has a great animation toolset. The new version is another step forward: making better use of AMD GPUs; adding camera zoom motion blur, new 'Flatten faces' and 'Edge offset' modelling tools, Pixar OpenSubdiv support and more.



Reeder 3

Spelling may not be its strong point, but for reading, it's a winner.

$14.99 | REEDERAPP.COM

RSS remains a viable format to receive news feeds from your favorite websites, but despite the abundance of native Mac clients, the technology hasn't flourished the same way Flipboard-style news readers have on smartphones and tablets.

One of the best reading applications around has finally received a much-needed desktop makeover, and it's free for users of the previous version.

Reeder 3 isn't a reinvention of Silvio Rizzi's popular Mac client, but it doesn't need to be. The previous version has been our go-to reading app on desktop and mobile for years, and the third release manages to take what was already great and kick it up a notch.

Our favourite 'read later' source, Instapaper, can now be configured as a sync service, turning Reeder into an unofficial desktop client for reading anything saved to your account. Reeder 2 introduced similar support for competitor Readability, so this is a fantastic addition for Instapaper fans.

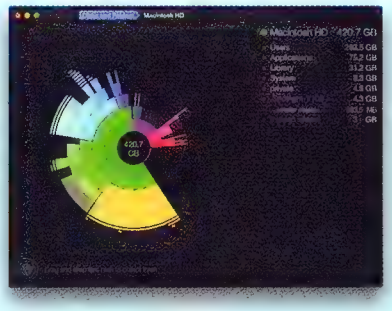
Saved articles are sorted by date with full access to archived stories and user folders, along with the option to plough through saved content from specific websites as well.The user interface remains functionally the same as Reeder 2, with the most obvious change being a new default transparent title bar across the top, which seamlessly blends into the familiar three-panel design. (If you prefer the previous grey bar, it can be resurrected from the Themes menu.) Likewise, buttons for switching between Starred, Reading List and All Items views have been reduced in size and made square instead of rounded for a more streamlined look.

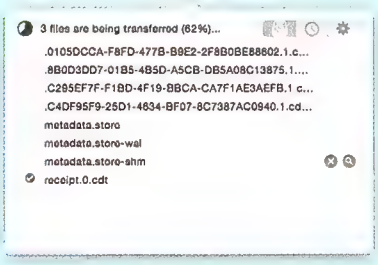
Reeder 3 also includes additional themes, including a pitch-black option for night owls. The update requires OS X Yosemite, but is also ready for OS X El Capitan, along with support for Apple's new San Francisco font and full-screen Split View.

Other nice little touches include unread and starred counts for smart folders and support for private browsing. Last but not least, individual sync services such as Feedly, Minimal Reader and Inoreader now have the option to add tags, along with article deletion from Readability.

Reeder 3 feels more like Reeder 2.5, but we're really not too bothered. This is still the best Mac RSS reader around.

JR Bookwalter





DaisyDisk 4

$14.99 | DAISYDISKAPP.COM

DaisyDisk visually pinpoints what's filling up your drives and slims them down with a few clicks. In this fourth version, the app has a new look and feel, one that complements the flat look of OS X.

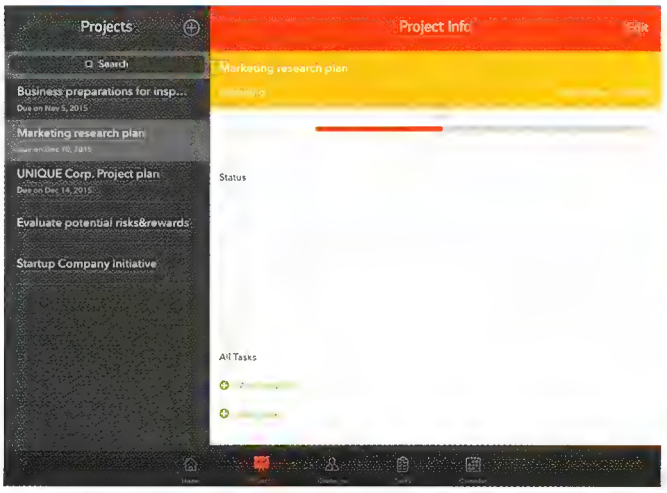
At launch, the application presents a list of available disks, including mounted network shares. Click Scan, and the application goes to work analysing them, presenting the contents in a colourful, interactive overview.

Although they vary with disk and CPU speeds, scans now consume less memory and take seconds, rather than minutes — up to 20x faster, especially with SSDs and quad-core processors. Drive contents are also listed, sorted by size, making it easy to drill down into folders and see where space-hogging files are lurking.

Once identified, files or entire folders can be dragged to the Collector at the bottom, where they reside until you choose to reject or delete them. Although the visual graph provides welcome eye candy for an otherwise routine utility, we found the list view easier to navigate in real-world use.

DaisyDisk 4 ramps up performance while conforming to the new OS X aesthetic.

JR Bookwalter



Daytime

Make your schedule as clear as day.

$14.99, LITE VERSION FREE | DK-DAYTIME.WEEBLY.COM

Whether you're managing a busy schedule at work, at home, at a freelance business, or even for an entire office staff, staying on top of projects and appointments has become one of the most crucial roles of the smartphone and tablet. One new app has a very good handle on helping get things done, but it's strictly for the iPad crowd right now.

Daytime offers a no-nonsense user interface with separate tabs for Projects, Contacts, Task and Calendar entries, plus a fifth Home button focused strictly on what needs to be addressed today and in the next seven days. From here, you can tackle the most current tasks in a colour-coded timeline.

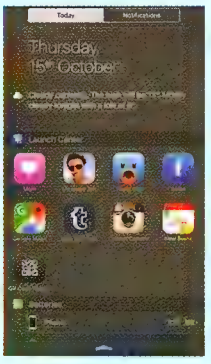
The design is well thought-out and there's even one-tap access to an extensive user guide. Daytime syncs with iOS and OS X Reminders, but also ties directly into contacts and projects, to give a broader scope of what's ahead.

The Tasks tab features an Inbox for quickly adding entries without having to know exactly how they'll fit into your overall schedule first. Tasks can also be attached to projects, with a progress bar showing what percentage of that work is already completed, and what has been delegated to specific users or companies. Tapping an email address allows sending new messages without having to exit Daytime, and Calendar events can be dragged and dropped to change start or due dates with a tap and hold. It's a comprehensive package, but missing one or two pieces of the puzzle — namely, companion apps for iPhone and Mac, which the developer says are already in progress.

Considering the wealth of available features, Daytime is worthy of a look for those dissatisfied with their current "get things done" solution. There's also a free Lite version available, although it doesn't actually do anything aside from run the sample data.

Daytime is a comprehensive app for efficiently tackling even the most challenging schedules. While it works great on iPad, you'll have to rely on other tools for getting things done on iPhone or Mac for the time being.

JR Bookwalter



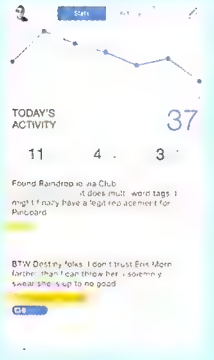
Launch Center Pro

$4.99 | CONTRAST.CO

This app lets you create your own shortcuts for doing things on iOS. It can simply launch apps for you, but also perform complex actions within those apps; queueing up common tasks for you, effectively. You can access these shortcuts either within the app itself in a grid, through its Today view widget or through 3D Touch on compatible phones. It's also massively expandable thanks to integration with IFTTT. Basically, it's there to make certain tasks easier to do on iOS. At least, that's the plan.

Launch Center Pro can be daunting. You may have an action in mind, but finding the right options isn't easy. There's a huge number of possible actions and the categorisation used is only helpful half the time. You also don't build complex tasks in easy to follow workflows, but rather just choose from a list.

Still, the possibilities are huge, but it's great even for something smaller. We were able to add a button to get directions back home in Maps right to the Today widget, along with a button to lock the brightness to 100% for correctly exposing video. It could do with being friendlier, but you might find this app invaluable once you get started with it. **Matt Bolton**



Tweetbot 4

$7.99 | TAPBOTS.COM

With this major upgrade, Tapbots has refined its Twitter experience in ways big and small, and unified its iPhone and iPad editions. Tweetbot 4 is about making one of the best Twitter experiences on any platform even better. A longstanding complaint about third-party Twitter clients is that they don't have an aggregate view of what's happening with your account. Twitter keeps much of this data close to its chest, leaving third parties with their hands tied.

Thankfully, the new Activity view in Tweetbot 4 solves this complaint. It's an aggregate view of your day's accomplishments — new followers, retweets, favourites — as well as a continually updating list of when tweets get new attention. It's a great way to see what people liked and what is still making the rounds on Twitter. Other big additions include support for the latest iOS features, such as 3D Touch on the iPhone 6S and 6S Plus, replying to a tweet or DM from a notification, and using Apple's new Safari in-app browser.

Tweetbot 4 has a new two-column view in landscape on iPad and Plus-size iPhones, and it also supports iOS 9's new Slide Over, Split View, and Picture in Picture iPad options.

It's difficult to find something to complain about. This would be a steal at even twice the price. **David Chartier**

Perch

Put your old Android back to work.

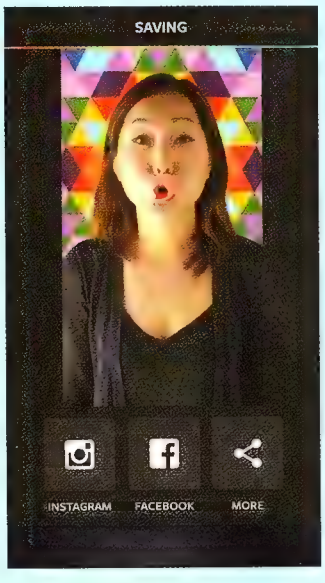
FREE | WWW.GETPERCH.COM

Here at APC, we have more than our fair share of old smartphones lying around the office and we've often thought about putting them to use — and even written a few how-tos based on the idea. One of the first things that comes to mind is an intercom or a wireless security setup, because smartphones (even the old ones) already generally have a camera and the processors to film and then transmit video wirelessly. Perch is a new Android app that wants to turn your old flagship device into a supercharged security camera. After downloading it, you sign up for a free online account and point your old smartphone's forward or rear camera to face what you want to capture. Then by just visiting the Perch website and using a browser-based interface and your login details, you can either view the live feed, or do things like set the phone app up to auto-record when it detects movement. While the app itself is basic at the moment (other than a couple of audio settings, there isn't much to tweak) it's definitely headed in the right direction. **Joel Burgess**

Boomerang

FREE | WWW.TINYURL.COM/TLA45-BOOM

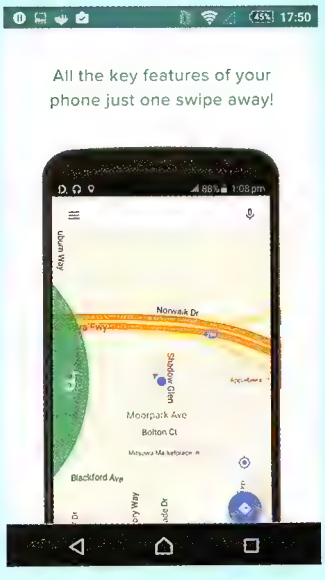
Life rarely stands still and, sometimes, a snapshot just doesn't cut it. Coinciding with the new burst photography modes for smartphones, Instagram decided to develop a modern app for people who want a little more animation from their photos. Boomerang takes a rapid series of photos, stitches them together like a GIF and then plays the animation forwards and then backwards — hence the name. Once you've taken the burst photos, you can choose to share it on a range of social media sites and other cloud storage applications like Instagram, Facebook, Dropbox, Evernote or Google Drive. For Instagram, you'll also get the opportunity to tweak the image's colouring, pick a cover image from the range of stills, or trim the clip down. If you want to snap moving objects for social media, using this clever animated-picture method is a great way to capture the dynamism of the moment without having to upload a whole raw smartphone video. **Joel Burgess**



Drivermode

FREE | WWW.DRIVERMODE.COM

One of the most important things to get right in a GPS app is to make it easy to use and to avoid it being a distraction while driving. Drivermode keeps that idea front and centre. It's not only one of the simplest driving companion apps available, it's got one of the best UIs we've seen. Full pages with simple background colours are dedicated to the settings, navigation, music and contacts sections, and the app vocalises each, meaning you can navigate without looking at the screen. The settings allow you to choose from third-party music apps to get your driving music happening, and also plug in your preferred mapping app. For Google Maps, there's an added feature that allows you to swipe left or right to move between the two applications. The same quick swipe actions work with the music player, too, allowing you to play, pause or flick between songs while on the GPS map. With automatic recognition of when you're in the car, this free app is better than some of the dedicated GPS ones out there. **Joel Burgess**



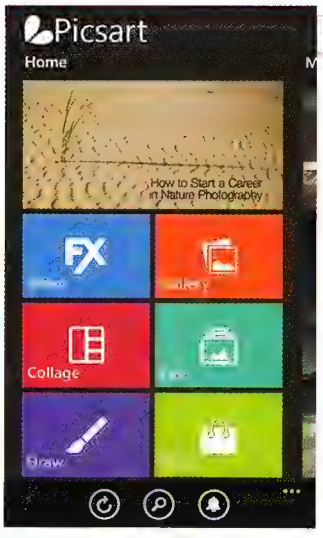
PicsArt

The smartphone Picasso.

FREE | WWW.PICSART.COM

This well-known Android and iOS photo-editing app has received a major update on the Windows Phone platform, which not only makes it a stable universal Windows 10 for Mobile app, but also brings the Windows Phone offering in line with the other smartphone platforms. Much like Instagram, PicsArt is a photography companion app aimed at sharing photos online, managing the process all the way from taking the shot itself through to editing and eventually sharing it on your PicsArt profile. The comprehensive editing suite has a full set drawing effects, allowing you to create art from scratch or tweak photos. Then there's a second editing level, which allows you to add further effects and filters. There are some pretty amazing customisations that can transform mundane objects into engaging images. This free app also plugs into a wide variety of social media apps, so even if you don't want your pics to join the other 250 million odd on the service, PicsArt makes for a great editing tool on its own.

Joel Burgess



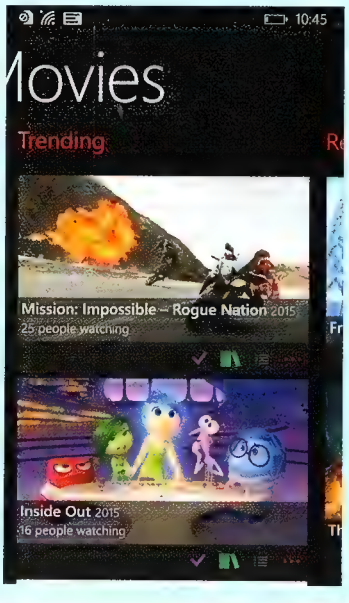
Trakter

$2.39 | WWW.TRAKTERAPP.COM

Trakter was first released on the Windows Phone a few months ago, but a recent update has added new features that increase the appeal. Trakter wants to help you keep track of movies and TV shows and connects to its own online repository. Though it doesn't have quite the sophistication of the similar IMDB app yet, it lets you create an account and flick through currently trending movies and best-ever lists to find something to watch.

One of the main perks is the ability to easily tap through to trailers when you stumble across something interesting. You can track your watched movies, though adding any more than 15 items will require you to download the $2.39 premium app upgrade... though from what we can tell, it isn't much better than the unimpressive free version. If you're not a movie/TV fiend, then IMDB's app will probably do; though if you're a rabid video consumer, then this one isn't too bad at its specific task.

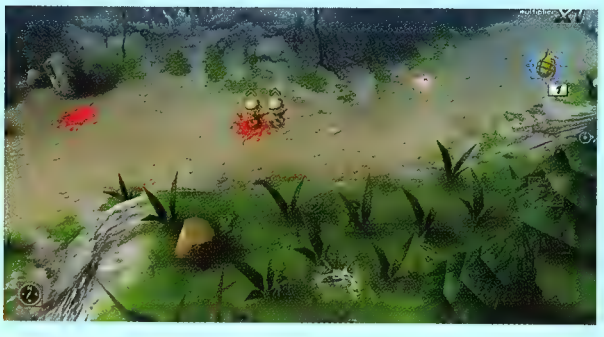
Joel Burgess



Tiny Troopers 2: Special Ops

FREE | WWW.GAMETROOPERS.NET

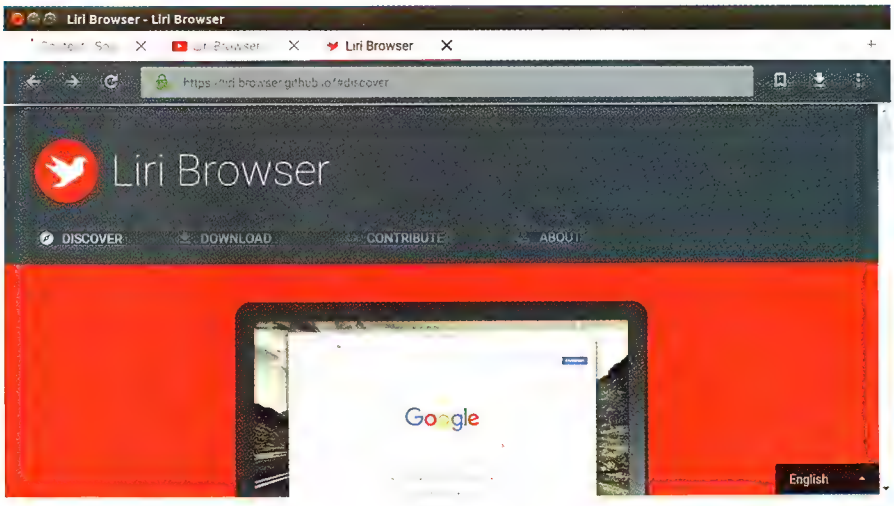
In this title, you're basically a helmet strapped to a pair of short legs wielding a rifle, a fistful of grenades or, on occasion, a tiny bazooka. The setting of *Tiny Troopers 2* is surprisingly well animated and the 3D landscape of this third-person shooter has a much more sophisticated feel to it than many comparable smartphone games. Though the controls are dead simple initially, knowing where to move your troops and how to return fire while evading incoming bullets requires a surprising amount of touchpad skill. What's refreshing about this title is that, although its revenue model revolves around in-app purchases, it can be completed without actually having to fork-out real money for upgrades and medical kits. There's definitely a steep learning curve and the game is difficult overall, but the levels are accomplishable after a few failed attempts, which ultimately strikes a good progression balance and keeps you engaged. We'd have to say it's one of the best Windows Phone games we've come across. **Joel Burgess**



Liri

Minimalist, zippy, open-sourced web browser.

FREE | BIT.LY/LIRIBROWSER



Here is a new addition to the family of Chrome-based web browsers. But do we really need another clone of Google's super-successful product? Well, let's see.

Liri is a student project of several junior developers from Germany, France and USA. The idea behind Liri was to craft a sleek, minimalist-looking web browser with a material design UI and the power of the Chromium project under the hood. To be precise, Liri uses the latest QtWebEngine code, which is based on the Chromium engine. The GUI is made using QML, which is the same technology used in the Plasma desktop, and Liri fits very well within Plasma 5 both in terms of the graphical toolkit it uses (Qt5 and QML) and the look and feel, as it matches the Breeze theme.

In other respects, Liri is a simplified version of Chromium 40 but with most of the 'redundant' features thrown away. It still retains a download manager, bookmarks, tabs and other essentials, but that's all so far. The Liri team also promotes its own source code viewer, which works remotely, like a cloud service. When you select the 'View source' item from the Liri main menu, the browser shows you the code using the service API at **http://bit.ly/LiriSourceCodeViewer** with very helpful colours and formatting.

This web-based viewer is also open source and is constantly being improved.

As Liri is a heavily trimmed down Chromium, it has a relatively small memory footprint of just 85MB after a cold start. The browser is currently in the early stage of development and is still missing some vital features, like password storing, plugins support and translations (contributors are very welcome), but it's surely worth a try thanks to its amazing speed and simplicity.

It's best to obtain Liri from its official Download page. The browser is cross-platform and, for Linux, it offers Debian repository, Ubuntu-compatible Deb package and the universal portable build in the ZIP format.

Alexander Tolstoy

Bomi

FREE | HTTPS://BOMI-PLAYER.GITHUB.IO

A sleek multimedia player, Bomi is designed to be a modern-looking GUI to the MPV back-end. It looks very stylish, with a Bomi-branded splash image stretched across the whole window and without any visible controls. To access the application menu you right-click anywhere in Bomi and follow the desired menu item. There's a tremendous number of features and options packed into this player.

First of all, certain benefits result from the MPV features. MPV is a fork of Mplayer, which has better support for remote URLs, streaming, OpenGL output, encoding functionality and modern optimised code (many ancient Mplayer elements were removed). On top of that, Bomi adds its own features, such as video interpolation, accurate seeking, subtitles adjusting, screensaver disabling etc.

Bomi's video-handling enables upscaling of a low-quality video and uses advanced algorithms, such as Lanczos and Unsharp mask, to offer a better quality picture.

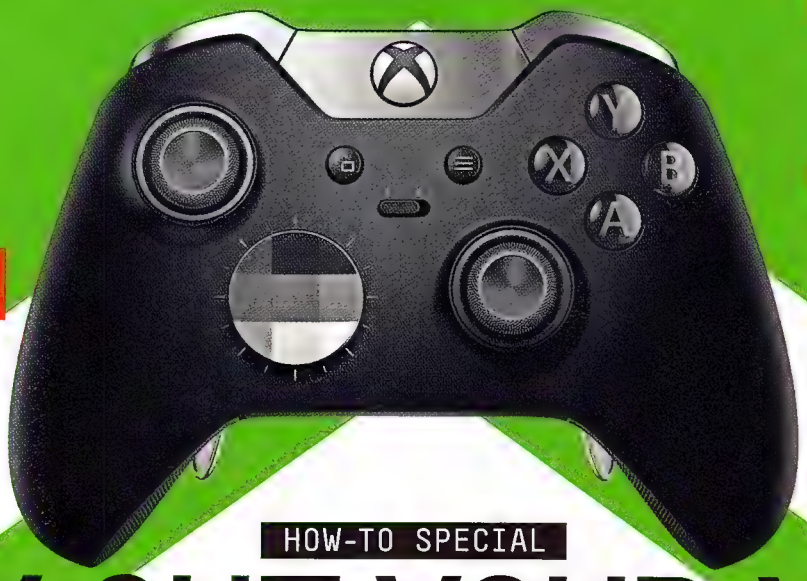
When a video is played, Bomi stays out of your way until you hover your mouse over the window. A semi-transparent OSD panel will appear with playback control buttons and some extras, such as a Playlist button, buttons for selecting different subtitles and audio tracks. There's also a 'hidden' panel, which rolls out from the left part of Bomi's window and provides the playback history.

We have to admit that Bomi is a very strong applicant for being the most advanced media player we've seen, packed with modern goodies, such as hardware acceleration, streaming support, playlist generation and more.

Bomi is a relatively new project and many popular Linux distros don't yet include it in their repos. However, the official Bomi Downloads page offers a bunch of packages that would satisfy many users, including Ubuntu, Arch, KaOS, OpenSUSE, Chakra and Fedora users.

Alexander Tolstoy

THIS MONTH



10

TOP TIPS TO CONQUER BLACK OPS III AND HALO 5 MULTIPLAYER

HOW-TO SPECIAL

MAX OUT YOUR XBOX

GET FREE GAMES! EARN MORE ACHIEVEMENTS! OWN THE BEST KIT!

RULE THE WASTELAND

FALLOUT 4

THE SECRETS & SURPRISES WE UNCOVERED DURING OUR FIRST 20 HOURS IN BURNT-OUT BOSTON

USE THE FORCE

STAR WARS BATTLEFRONT

GRAB THE BEST GEAR FIRST WITH OUR FIVE TOP ONLINE TRICKS

EXCLUSIVE AND MUST-KNOW INFO ON THE BIGGEST GAMES OF THE YEAR **GRAB YOUR COPY TODAY!**

ON SALE NOW

ULTIMATE AFFORDABLE UPGRADES

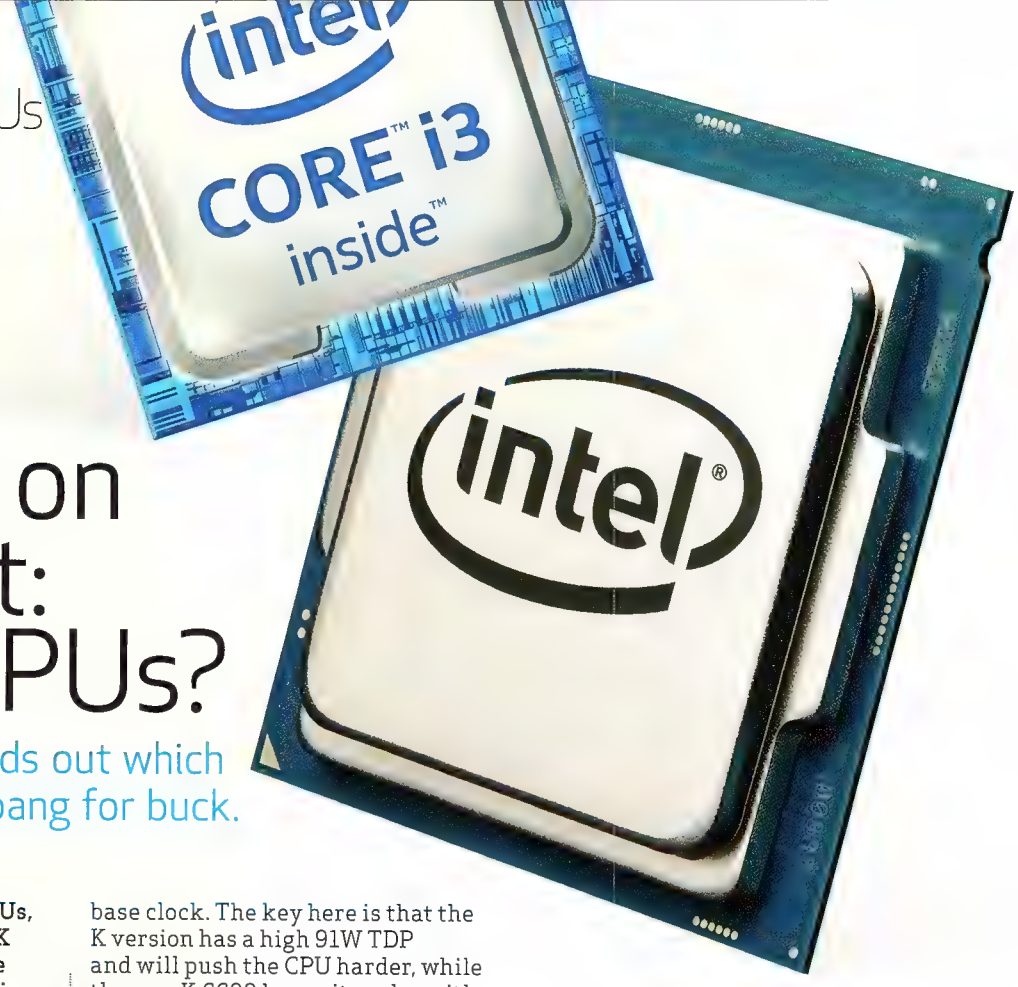
UNCOVERED: ALL THE BEST BITS FOR BUILDING A BRILLIANT BUDGET PC THIS XMAS!

52
SKYLAKE ON A BUDGET: WHICH CPUS?
Which new processors give the best bang for budget buck?

54
ENTRY-LEVEL H170 & B150 MOTHERBOARDS
Want to build a new Skylake system for less?

60
SURE-BET SSDS
Solid-state drives are cheaper than ever, but that doesn't mean they all perform the same.

66
PSUS WITHOUT THE HIGH PRICES
New, more power-efficient Intel CPUs allow for smaller power supply units. Darren Yates rounds up eight of the latest affordable PSUs.



Skylake on a budget: Which CPUs?

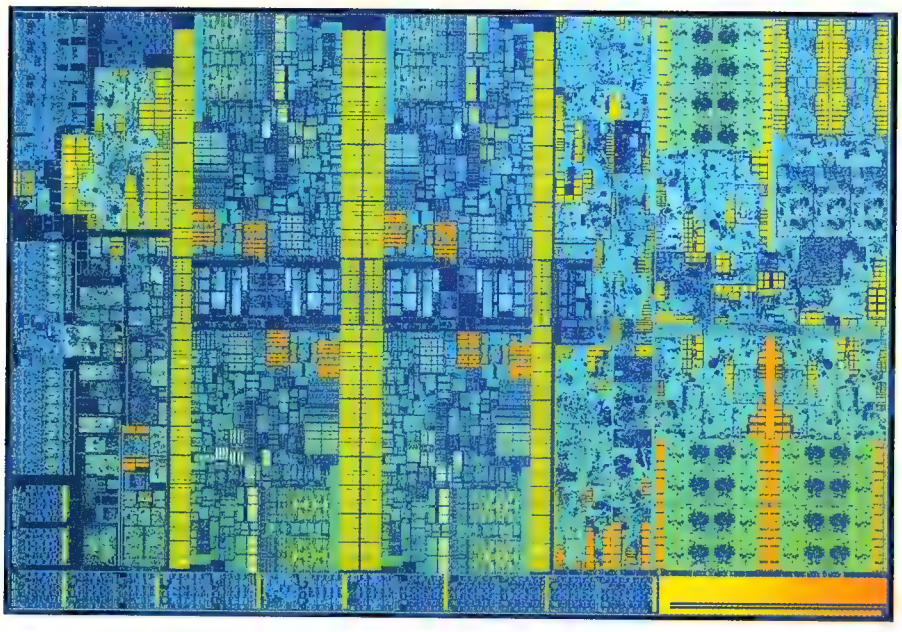
Lindsay Handmer finds out which CPUs give the best bang for buck.

The first of the Skylake CPUs, the i7-6700K and i5-6600K went on sale earlier in the year. Now the 'non-K' versions have arrived, including a range of affordable quad core i5 and dual core i3 processors. Compared to their K brethren, non-K CPUs are typically slightly slower, use less power and don't support overclocking. The i5s don't have hyper-threading, while the i3s do, and they all use the Intel HD Graphics 530.

The top end of the mid-range quad core CPUs is the i5-6600, with a base clock of 3.3GHz and the ability to boost up to 3.9GHz on a single core. Boosting all four cores is relegated to 3.6GHz. In comparison, the 6600K can also boost up to 3.9GHz, but can do so with all cores, and has a higher 3.5GHz base clock. The key here is that the K version has a high 91W TDP and will push the CPU harder, while the non-K 6600 keeps it cooler with a 65W TDP.

This all means the K version is about 7% faster and, funnily enough, costs about 7% more, so the value for money is about the same. The key difference is that the K version can be over-clocked, which is an easy way to boost performance further. On the flip side, the non-K version does use less power, and for normal use, might shave $15 per year off the electricity bill.

In the i5 range, the 6500 and 6400 have no K versions, and replace the older Haswell i5 CPUs. The i5-6500 has a base clock of 3.2GHz, can boost all the cores to 3.4GHz and a single core to 3.6GHz. The i5-6400 scales things back to a 2.7GHz core base clock, a 2GHz boost across all four cores and a peak of 3.3 GHz on one core. The 6400 also only boosts the Intel HD 530 graphics to 950MHz, vs the 6500's 1,150MHz. Both have a 65W TDP. For most use, the 6600 is about 8% faster than the 6500. Depending how hard you ferret out the cheapest prices, it's about 8% to 12% cheaper to buy the 6500, which makes it mildly better bang for buck.



The i5-6400 is about 10% slower and cheaper than the 6500, which means while it's slightly better bang for buck than the i5-6600, it's not really better or worse value for money than the 6500. The upshot here is that all the new non-K Skylake CPUs offer comparable value for money, so its matter of picking the one best suited to your build and budget. It's worth noting, though, that fluctuating exchange rates and local pricing mean it's very important to shop around for the best deal.

The dual core Skylake i3 units come in three flavours: the i3-6320, the i3-6300 and the i3-6100, running at 3.9, 3.8 and 3.7GHz, respectively. The i3s don't have boost — instead they run at full speed as needed, but do have hyper-threading. The TDP is 51W, which is actually not that much lower than the i5's 65W. The bottom end i3-6100 only boosts the Intel HD 530 graphics to 1,050MHz, vs 1,150MHz for the faster i3s and has 3MB instead of 4MB of cache.

MIDRANGE PICK: CORE i5-6500 ($300)

Out of the new Non-K i5s, the 6500 offers the best bang for buck. It's powerful, yet costs under $300. That said, its faster and slower i5 brethren are also good deals, depending on the budget.

The i5 won't offer full value, though, unless used with applications that work all four of the cores pretty hard. The extra grunt will help with gaming, but only with the higher end of the mid-range GPUs. The last gen competition is the 3.7GHz i5-4590 from 2014, which is slower and more expensive to buy now, but not really worth upgrading if it's in an existing system.

ENTRY-LEVEL PICK: CORE i3-6100 ($175)

Perfect for budgeting gaming and day-to-day desktop builds, the i3-6300 offers a lot considering the low price. For single core loads, it can easily keep up (and best) an i5 that costs $100 more. With hyper-threading, it performs well under multicore loads, but does fall behind. For budget to mid-range gaming (when paired with a modest GPU), the i3-6100 gives very respectable performance, whilst also offering enough headroom to keep up for a few years to come. For older or less taxing games, the GPU is the bottleneck, and the faster CPU makes little difference to frame rates.

At the time of writing, the i3-6320 is not available in Australia, and the 6300 is barely available or pre-order only and expensive. The silver lining is the i3-6100, which costs about $175. In our testing, it offers about 97% of the performance of the 6300, despite being 20–40% cheaper. Based on benchmarks, the 6100 offers about 95% of the processing grunt of the unavailable 6320, which would cost 60% extra if ordered from overseas.

For users with a current Haswell i5 or i3, Skylake isn't a game changer. The new CPUs offer between 5% and 15% better performance and while the power savings are decent (25% or so), it won't shave a lot off the electricity bill. To new users, the Skylake CPUs are cheaper and faster than the older Haswells (or AMD's nearest competitors) still for sale, and even the affordable motherboards have a range of good features. The Intel HD 530 graphics are acceptable for fairly casual gaming, but a mid-range GPU (such as the GTX 950) is a better bet.

> "Fluctuating exchange rates and local pricing mean it's very important to shop around for the best deal."

Thanks to the H170 and B150 chipset, there are cheap but capable upgrade options to run Skylake CPUs. The processors can use DDR3, and while most motherboards are DDR4, some can take both, or just the older RAM. While it seems like a good idea to reuse existing memory in a new build, it's generally not worth it unless you have a lot of it, or it's particularly fast.

HOW WE TESTED

The i5-6600, i3-6300 and i3-6100 were tested in an MSI H170 Gaming M3 motherboard, with 8GB of 2,133MHz DDR4, a Samsung 850 Pro SSD and MSI GTX 950 GPU. Comparison benchmarks were compiled from available online scores. ■

AFFORDABLE SKYLAKE CPUs COMPARED

	MAX GHZ	PRICE $	CINEBENCH MULTI	CINEBENCH SINGLE	X264 PASS 1	X264 PASS 2	GTA V (AV FPS)	GRID 2 (AV FPS)	3DMARK FIRE STRIKE
I5-6600	3.9	325	604	167	49.72	14	43.23	80.49	5855
I5-6500	3.6	300	571	152	N/A	N/A	N/A	N/A	N/A
I5-6400	3.5	275	502	140	N/A	N/A	N/A	N/A	N/A
I3-6320	3.9	N/A	427	166	N/A	N/A	N/A	N/A	N/A
I3-6300	3.8	249	418	162	41.64	9.54	41.74	80.19	5779
I3-6100	3.7	175	410	159	40.77	9.41	41.56	80.21	5669

apc RECOMMENDS

mATX, VGA, DVI, HDMI, Realtek ALC887, Intel Gigabit LAN, 4 x PCIe slot, 1 x M.2, 1 x SATA Express, 6 x SATA 6Gbps, USB Type-C

$175 | WWW.ASUS.COM/AU

Entry-level H170 & B150 motherboards

Want to build a new Skylake system for less? Lindsay Handmer tests eight wallet-friendly motherboards to consider.

For those budget computer and gaming builds, the new H170 and B150 chipsets offer pretty good value for money. Compared to Intel's first 6th-generation chipset, the Z170, H170 and B150 have fewer PCIe and HSIO lanes available, at 16/22x and 8/14x, respectively. They both also lose the ability to overclock CPUs and RAM, and the B150 can't run drives in RAID either. The H170 also has six SATA 6Gbps ports, vs four on B150. USB 3.0 support is also different, with the B150 having 10 possible ports, vs 14 on H170.

But while the H170 and B150 are missing a few features, the chipsets are good options for those wanting to build a mid-range computer with plenty of bang for buck. They also pair well with the new 'non-K' Intel Skylake processors, as neither can overclock.

The boards basic CrossFire support, but don't have the bandwidth for SLI. Both chipsets can also support SATA Express, or M.2 drives of either SATA or PCIe x4. Manufacturers are free to configure their boards differently though, so there are a few different storage connectivity options available, including USB 3.1. The trick is to find the features your particular build needs, at the price you want to pay. Performance is a secondary concern, as all the boards we tested (both H170 and B150) give very similar results.

Currently, it's particularly important to check and compare prices, as the fluctuating exchange rates mean big differences in cost, depending when supplies bought their stock.

How we tested

The motherboards were tested with a Core i5-6600 CPU running the stock cooler, as well as 8GB of 2,133MHz DDR4, a Samsung 850 Pro SSD and a MSI GTX 950 GPU. Games were tested on High settings at 1080p.

ASUS H170M-Plus

Packs features not available anywhere else.

So far, H170 motherboards don't tend to have a huge amount of variation or custom options. The ASUS boffins couldn't live without USB Type-C, though, and added a port onto the back of this particular motherboard. While it might be unnecessary for a lot of buyers, it's a great way to future-proof external connectivity.

Storage wise, the Plus has an M.2 Socket 3, which uses the M Key and can handle both SATA and PCIe SSDs. You also get a SATA Express connection, as well as six SATA 6Gbps ports that support RAID. Up to 64GB of 2,133MHz DDR4 can be installed across four slots. Two x16 PCIe connections run CrossFire, but the second card is limited to x4. There are also another two PCIe x1 slots for expansion cards. Performance is excellent, and ASUS bundles in a lot of extra value through software, such a tuning utility and fan control.

The board uses the Intel Gigabit LAN controller, and has VGA, DVI and HDMI ports round back. On the rear, the H170M-Plus only has two USB 3.0 ports (as well as two legacy USB 2.0), although four more of each are available via motherboard headers.

The ASUS board used the Realtek ALC887 codec, which is a step down from the 1150, or even the 892, seen elsewhere. More important though is the implementation (not to mention speaker/headphone quality), which is still good, though it's let down by only three 3.5mm audio I/O jacks and S/PDIF only being available via an internal header.

Verdict

Good all round performance and features, plus USB Type-C.

★★★★½

mATX, VGA, DVI, HDMI, DisplayPort, Realtek ALC892, Gigabit LAN, 4 x PCIe slot, M.2 SATA, 4 x PCIe slots, 6 x SATA 6Gbps, 6 x USB 3.0

$150 | WWW.ASROCK.COM

ASRock H170M Pro4

What do you get from a cheaper H170 motherboard?

ASRock has a higher-end Fatallty H170 motherboard available, but this micro-ATX Pro4 is only 85% of the price. Spec wise, one noticeable omission is a SATA Express connection. On the flip side, the board handles SATA Gbps and PCIe M.2 SSDs, so high-speed storage is covered. The other big difference is the sound, which relies on an older codec.

The Pro4 supports 64GB of 2,133MHz DDR4, across dual channels and four slots. It's got dual PCIe x16 slots (running x16 and x4) that support CrossFire, as well as another two PCIe x1 connections. The board has a M.2 socket (SATA 6Gbps or PCIe x4), and six standard SATA 6Gbps connectors.

Not surprisingly, performance is excellent, and the board is not appreciably slower than its more expensive brethren. The BIOS is also well laid out and simple to navigate.

Round the back, you get VGA, DVI, HDMI and DisplayPort, and it can output video from three of those sockets at once. The 7.1 channel audio uses the Realtek ALC892 codec, with ELNA capacitors. Unless you have better-than-average speakers or headphones, that quality is as good as you'll likely need. The Pro4 also has Intel Gigabit LAN, power spike protection and a legacy PS/2 port for older peripherals, plus six USB 3.0 connections on the rear – if you want more USB, 2.0 connections are available via an internal header.

ASRock also has an okay array of freebie software, including a tuning utility and a USB key login.

Verdict

A solid all round motherboard at a very affordable price.

★★★★☆

ATX, VGA, DVI, HDMI, Realtek ALC1150, Killer E2201 LAN, 4 x PCIe slots, 2 x M.2, 2 x SATA Express, 6 x SATA 6Gbps, 4 x USB 3.0, 2 x USB 2.0

$199 | WWW.GIGABYTE.COM.AU

Gigabyte H170-Gaming 3

With extras for those who like to customise their audio.

Nosing towards the higher end of the affordable H170 range, the Gaming 3 nonetheless manages to stay under $200. This ATX form factor motherboard takes four DDR4 chips, at up to 2,133MHz, dual channel. It also has an x16 PCIe slot, as well as a second x4 PCIe connection. For other upgrade cards, there are dual slots for both PCIe x1 and PCI. You can run two-way CrossFire on the H170, but no SLI. The board also has metal shielding over the PCIe slots for extra durability and a funky programmable LED system.

For those who want an SSD upgrade, the Gigabyte motherboard has dual PCIe Gen3 x4 M.2 slots that can handle speeds up to 32Gb/s. There are also dual SATA Express ports, plus six SATA 6Gbps connections. Rather than the standard Intel Gigabit LAN, the Gaming 3 uses the Killer E2200 to handle the wired network connection. Round the back are HDMI, DVI and VGA outputs, as well as PS/2, dual USB 2.0 and four USB 3.0 ports.

The Gaming 3 uses the Realtek ALC1150, and produces better than average 7.1 channel audio.

One cool little extra with the Gigabyte audio is customisable OP-AMPS. Users can tweak the sound of their board by buying and installing different chips, which are available separately from about $10 each or as a Gigabyte kit.

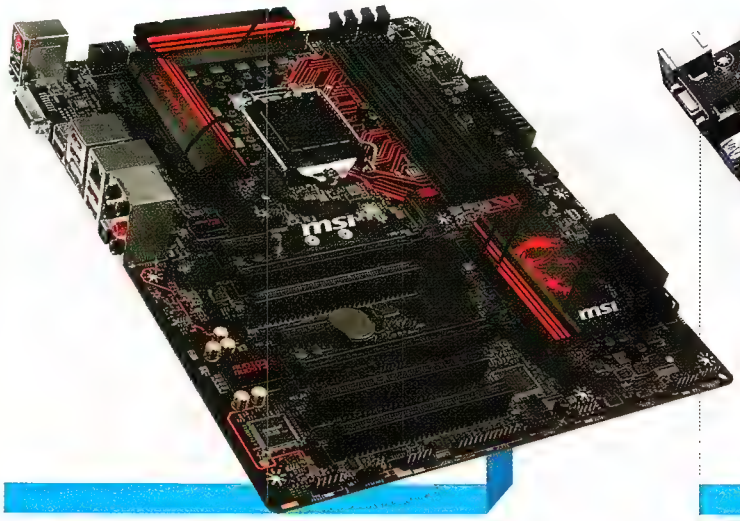
The H170-Gaming 3 is a pretty solid package, with a good mix of performance and higher-end features without blowing out the budget.

Verdict

Still surprisingly affordable, considering the strong set of features.

★★★★☆

ATX, DVI, HDMI, Nahimic Audio, Killer E2400 LAN, 4 x PCIe slot, 1 x M.2, 1 x SATA Express, 6 x SATA 6Gbps, 6 x USB 3.0



$219 | AU.MSI.COM

MSI H170 Gaming M3

Aimed at gamers who want all the latest features.

The M3 is on the higher end of H170 board prices, but promises a lot for the money. Like the competition, it uses dual channel DDR4 across four slots at up to 2,133MHz. This ATX board also has dual PCIe x16 slots, as well as two PCIe x1 and another three PCI connections for your extra upgrades. It can handle CrossFire (but not SLI) and the slots have extra reinforcing. The Gaming M3 has both a SATA Express and Gen3 4x M.2 connection, for next gen SSD speeds.

Performance is excellent, as expected, and the M3 easily extracts the best from your Intel CPU.

The MSI board has a special LAN setup, aimed at gamers. At the heart is the Killer E2400 NIC, coupled to the MSI LAN manager software. It's also got surge and anti-static protection for extra peace of mind. The MSI has a few OC features (such as Debug lights and a slow boot mode switch) in case you do end up running an overclockable CPU.

MSI uses Audio Boost 3 with Nahimic Sound tech, while the underlying codec is the Realtek ALC1150. Not only does it sounds excellent, it's isolated from the main board, has a dedicated headphone amplifier and can output 7.1 channel audio. On the back, the board has both DVI and HDMI, as well as PS/2, and four of both USB 3.0 and 2.0 ports.

The Gaming M3 has a range of handy software extras, such as streaming software, OC tweaking and a RAMDisk utility.

Verdict

The higher price is worth it if you need the full set of features.

★★★½☆

ATX, VGA, DVI, HDMI, SupremeFX Audio, Intel Gigabit LAN, 2 x PCIe x16 slots, 1 x M.2 M Key, 6 x SATA 6Gbps, USB Type-C, 4 x USB 3.0

apc RECOMMENDS

$220 | WWW.ASUS.COM/AU

ASUS B150 Pro Gaming/Aura

For gamers who want a bit of bling.

This ATX form factor ASUS B150 motherboard supports 64GB of 2133MHz DDR4 and has two PCIe x16 slots that can handle CrossFire. It also has two more PCIe x1 slots, plus a pair of PCI connection for all your upgrade cards. SATA Express is absent, but the M.2 socket can handle both SATA and high speed PCIe SSDs. Normal drives are catered for with six SATA 6Gbps connections.

Round the back, the Aura has four USB 3.0 ports (plus two USB 2.0) as well as dual USB 3.1. One connection is the standard Type-A, while the other is Type-C. This is actually a very handy feature and gives an element of future proofing with external storage and connections. You also get Gigabit LAN, PS/2, S/PDIF, VGA and HDMI connections.

For gamers who want to stand out, the Aura part of the Pro Gaming board means it has funky LED lights built in. They are RGB too, so you can change it at will, or have it reflect CPU temperature or beat along with music. The ASUS SupremeFX audio uses the Realtek ALC1150 codec, and the sound quality is some of the best we experienced.

The ASUS B150 isn't really any faster (or slower) than the competition's boards, but has a range of gamer-focused software extras. Sonic Radar II helps track in-game sounds, RAMCache decreases load times, GameFirst IV prioritises network packets and AI Suite 3 makes it easy to balance between performance, cooling and efficiency.

Verdict

Worth the extra cost if you want to stand out with gamer focused features.

★★★★☆

mATX, VGA, DVI, HDMI, Realtek ALC892, Intel Gigabit LAN, 2 x PCIe slot, 1 x M.2, 1 x SATA Express, 6 x SATA 6Gbps, 6 x USB 3.0

$133 | WWW.GIGABYTE.COM.AU

Gigabyte B150M-D3H

How well does the cheapest B150M motherboard tested stack up?

It's worth noting that a huge range of prices exist for this board, but at the time of writing, it is available for as little as $119, but more easily in the low $130's. At this price it's specs are basic and there are really no surprises. You get support for 64GB of 2133MHz DDR4 across four slots, as well as two x16 PCIe slots – the second of which runs at x4. The D3H has two-way CrossFire, and you also get another two PCI slots for upgrade cards. Typical storage is handled by six SATA 6Gbps connectors, as well as a single SATA Express port. The board also has M.2, which uses Socket 3, M Key, and can handle SATA or PCIe x4 SSDs.

Round the back are VGA, DVI and HDMI ports, as well as Intel Gigabit LAN, PS/2, four USB 3.0, two USB 2.0, with another two and four connections available via internal headers.

Audio is handled by the Realtek ALC892 codec, which is a generation old, but probably still better than most consumer speakers and cans need. It has 7.1 channels via 3.5mm jacks, funky lights, as well as support for S/PDIF output.

The B150M-D3H may have the stereotypical feature set, but the Gigabyte boffins have tied it all together really well. This board punches above it's weight when it comes to performance, especially considering the price. And Gigabyte also has a fairly comprehensive selection of free software, such as a tuning utility and handy remote control and sharing via a smartphone.

Verdict

Pretty standard, but in a wonderfully affordable and well put-together way.

★★★★½

mATX, VGA, DVI, HDMI, 7.1 Channel ALC892 Audio, Realtek Gigabit LAN, 2 x PCIe 16x slot, M.2 Type E, SATA Express, 6 x SATA 6Gbps, 6 x USB 3.0

$149 | AU.MSI.COM

MSI B150M Mortar

Explosive projectiles sold separately

A little more expensive than the cheapest B150 boards, but still on the very affordable side, the Mortar positions itself as a gaming focused option. It's not just all about hardware spec either, with some extra features such as controllable LED lighting, streaming software and gaming LAN management options.

The Mortar handles up to 64GB of 2133 MHz DDR4 and has dual reinforced x16 PCIe slots that support CrossFire. You also get another two PCIe x1 connections allowing for extra add in cards.

SATA 6Gbps hard drive or SSD connectivity is handled by six ports, as well as a single SATA Express connector. The board also has an M.2 slot, but there is a catch – it's type E. That means that while it is PCIe x2, the connector is used for add in cards such as Wi-Fi and Bluetooth, and won't work with the typical M-key SSDs. It's still a handy extra – especially for those who want to go wireless, but won't appeal to all buyers.

The Mortar ekes out top performance from the Skylake CPUs, and while the difference is ultimately small, this was one of the best performers we tested. The MSI Click BIOS5 is also particularly good, and makes it easy for those who want to tweak their settings. The onboard graphics is fed out via VGA, DVI-D and HDMI, with the latter able to handle up to 4K resolution.

Audio, while not audiophile level, is pretty decent thanks to the Realtek ALC892 codec and you get 7.1 channels, plus S/PDIF output.

Verdict

Gaming-focused features without going overboard on price.

★★★★½

Form Factor: mATX, VGA, DVI, HDMI, Realtek ALC892, Intel Gigabit LAN, 4x PCIe slot, 6x SATA 6Gb/s, 6x USB 3.0

$135 | WWW.ASROCK.COM

ASRock B150M Pro4

Is it worth saving a bit of money with this $135 option?

Compared to the H170M Pro4, ASRock's B150M ditches a few things to come in at about 10% cheaper. That doesn't sound like a lot, but for a budget build, it could free up enough cash to upgrade to a better video card. One major hardware difference is the lack of an M.2 connector – the board only has six SATA 6Gbps connections. M.2 SSDs are more expensive per GB, so those on a budget may not really care. Of course, the higher speed drives can always be added via a PCIe port too.

The B150M-Pro4 doesn't do anything remarkable – it supports the standard 64GB of 2133 MHz DDR4 across four slots. PCIe connectivity consists of a x16, x4, and two x1 slots, and supports CrossFire. Round the back you have VGA, DVI, and HDMI connections, but there's no DisplayPort. You also get PS/2, four USB 3.0 and Intel Gigabit LAN. Audio quality is pretty good, thanks to the older but still competitive Realtek ALC892 codec.

The ASRock B150M Pro4 gives strong performance for the price – the key differences compared to more expensive boards are more about the features, rather than eking out a few extra FPS. There are also a few free utilities included, such as LAN Manager, and the ability to charge USB devices when the computer is switched off.

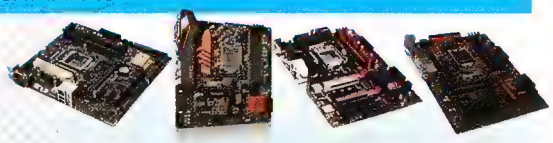
Like the ASRock H170 board, the B150M also has a more expensive Fatal1ty counterpart. That will set you back an extra $34 (around 25% extra), but has a Killer E2400 NIC and the newer Realtek ALC1150 audio codec.

Verdict

Avoiding a few features makes this a very affordable board for the right build.

★★★½

BENCHMARKS



	ASUS H170M-PLUS	ASROCK H170M PRO4	GIGABYTE H170-GAMING 3	MSI H170 GAMING M3
PRICE	$175	$150	$199	$220
CINEBENCH R15 SINGLE / DUAL	167 / 604	166 / 603	167 / 602	167 / 603
OPENGL	128.01	128.42	128.14	128.79
X264 PASS 1/2	48.78 / 14.12	49.20 / 14.21	49.25 /13.97	49.50 / 14.03
AS SSD SEQ READ WRITE	505.68 / 477.25	505.14 / 479.22	505.99 / 480.74	506.12 / 479.49
4K READ WRITE	30.27 / 98.56	30.47 / 98.99	30.94 / 99.08	30.91 / 97.63
HEAVEN SCORE	1036	1037	1037	1039
ICE STORM EXTREME	141389	141401	141354	141692
CLOUD GATE	17601	17643	17645	17691
SKY DIVER	17439	17421	17455	17458
FIRE STRIKE	5864	5847	5869	5895
GRID 2 AV/ MIN/MAX	81.29 / 61.01 / 105.09	80.15 / 61.24 / 104.78	81.23 / 62.14 / 105.74	81.88 / 62.20 / 105.75
GTA V AV FPS	43.27	43.02	43.19	43.22

	ASUS B150 PRO GAMING/ AURA	GIGABYTE B150M-D3H	MSI B150M MORTAR	ASROCK B150M PRO4
PRICE	$220	$133	$149	$135
CINEBENCH R15 SINGLE / DUAL	167 / 603	167 / 604	167 / 603	166 / 604
OPENGL	128.74	128.09	128.5	127.98
X264 PASS 1/2	49.85 / 13.99	49.72 / 14	49.09 / 14.05	48.92 /14.05
AS SSD SEQ READ WRITE	504.73 / 479.38	505.07 / 468.28	504.36 / 480.23	504.45 / 480.91
4K READ WRITE	30.55 / 99.02	30.24 / 99.68	30.73 / 98.36	29.97 / 97.68
HEAVEN SCORE	1036	1036	1038	1037
ICE STORM EXTREME	141423	141225	141569	141263
CLOUD GATE	17629	17618	17677	17654
SKY DIVER	17412	17431	17430	17444
FIRE STRIKE	5865	5877	5915	5854
GRID 2 AV/ MIN/MAX	80.33 / 61.87 / 104.97	80.49 / 62.81 / 105.12	81.26 /61.30 / 105.48	80.56 / 61.14 / 104.66
GTA V AV FPS	42.78	43.08	42.14	42.85

fractal design

scorptec

VENOM GAMINGPC GOLD X99 980

apc HOT PRODUCT

Powered by a Fractal Design
award winning power supply

Ready to Run
SCORPTEC BUILT & TESTED

fractal-design.com

Fractal Design brings you Scandinavian design and quality

Sure-bet SSDs

Solid-state drives are cheaper than ever, but that doesn't mean they all perform the same. Ashton Mills took 11 affordable SSD drives and compared them on performance and price.

Where once a machine was bottlenecked by the speed of its hard drive, the advent of SSDs has changed all that. SSDs are so fast, in fact, that beyond benchmarking or very specific workload requirements, getting most any SSD will give a computer a huge performance boost. You don't have to spend a lot of money, and the performance difference between a lower-end and cheaper SSD and the top-end variety is not something you're likely to see or feel in everyday use.

Indeed, you will often see metrics like IOPS (input/output operations per second, commonly used for indicating peak throughput) quoted in reference to an SSDs performance, but this has almost no bearing on normal use for the majority of the population.

As with any hard drive purchase, the important features to look for are size and price, and ultimately longevity, though this is something not easily tested. In fact, your average SSDs today is *supposed* to last ten years with heavy use. But don't for one minute think that means your data is safe — APC staffers have had SSDs spontaneously die on them, so just as with the old spinning platter hard drives that SSDs are replacing. Always, *always* back up your data regularly.

For our test, we looked at drives that came in under $0.70/GB. Corsair, ADATA, G.Skill and Transcend were invited but elected not to provide products for review.

WHAT TO LOOK FOR

When it comes to buying an SSD, you'll usually get slightly more bang for buck by going for a larger drive, as the economies of scale kick in. There's another advantage for going for a larger drive too. By their nature, SSDs have limited write-cycles for non-volatile RAM that they use, and to help a drive last a long time, on-board firmware uses 'wear-levelling' to spread data out across the least-used cells. This means that the more free space you have available, the better these algorithms can ensure a longer life your drive, and of course it's easier to have more free space with a bigger drive.

If performance is important, you'll see there is a difference between the drives in our test, with better performing drives usually costing more, too. In our tests, we've not only measured performance but also looked at cost per gigabyte, as well as performance per cost per gigabyte, which informs value for money.

"As with any hard drive purchase, the important features to look for are size and price, and ultimately longevity, though this is something not easily tested."

$239 | WWW.CRUCIAL.COM

$275 | WWW.CRUCIAL.COM

$159 | WWW.INTEL.COM

Crucial BX200 480GB

Big drive without the big price tag.

Crucial has made a name for itself in the SSD market and the BX200 is no exception. And as the cheaper brother of the MX200, and over-provisioned to 480GB, it performs about the same in the PCMark 8 storage results.

However, where it excels over its sibling is in write speeds, particularly in 4k sequential and threaded writes where it performed around 20% faster.

At a street price, the BX200 comes in at exactly $0.50/GB, which is about average and better than the MX200's $0.55 per gigabyte, though it's also a smaller drive.

At its peak, throughput in Crystal DiskMark the BX200 managed around 560MB/s read and 480MB/s write, which is on par with most of the other drives in this roundup. And indeed, while not the highest scorer in the PCMark 8 storage suite, it held its ground in the middle.

Verdict

Among the cheaper of the 480GB models we tested, with good performance and excellent bang for buck.

★★★★½

Crucial MX200 500GB

Crucial's faster, larger brother to the BX200.

The MX200 comes in at 500GB, the largest in our roundup, and and at roughly $35 more expensive than its BX200 brother. This extra cost gets you extra performance, coming second only to Samsung's 850 Evo by a small margin. Its peak throughput with Crystal DiskMark was on par with the Crucial BX200, though it did score a little less in 4k threaded writes compared to its brother.

At $0.55/GB, it's in the middle in terms of cost effectiveness, but this extra cost pays off with the MX200 being the fastest among the 480GB drives we tested, giving it a decent ranking in our value index.

Beyond this, however, the BX200 and MX200 are very similar and both come with Crucial's Storage Executive, which provides for easy firmware updating, SMART monitoring, and secure-wiping the drive.

Verdict

More expensive, faster, version of the BX200 with 20GB more space to boot.

★★★★☆

Intel SSD 535 240GB

A cost-effective entry point into the reliable Intel brand.

Intel is, of course, renowned for making solid SSDs that prioritise reliability, but also cost a premium. However, the 535 240GB comes in at $0.66/GB – still the joint most expensive in our roundup, but below our $0.70/GB target.

In terms of performance, the 535 shows its pedigree, but doesn't quite keep up with most of the drives in this test. While its read speeds are excellent across the board in Crystal DiskMark, it doesn't keep up in write performance, peaking at around 260MB/s for sequential and 4k threaded writing, compared to most of the other drives in this test, which hit between 400 and 500MB/s in write speeds.

As noted in the introduction, while reliability is an important consideration, it's also very hard to quantify, but if you put stock in the Intel brand, then the 535 is among its more affordable SSDs.

Verdict

Intel pedigree but middle of the road performance and value.

★★★½☆

$149 | WWW.KINGSTON.COM

Kingston HyperX Savage 240GB

Flash looks combine with fast speeds to impress.

With a moniker like Savage, we'd expect a blistering fast experience from this drive, and it mostlu lives up to this expectation – coming in just behind the Samsung 850 Evo, Crucial MX200 and OCZ Vector 180 drives. However, it's considerably cheaper than Crucial's top-performing MX200, and a tad more expensive (give or take what price you can find) to Samsung's 850 Evo.

Peak throughput according to Crystal DiskMark is exemplary, with a super-fast 560MB/s read and 540MB/s write.

Of note with the HyperX Savage 240GB and its 480GB brother is a heavy and solid build to the drive, not to mention perhaps the sleekest looking SSDs in our test – mostly moot for those who install them never to be seen again, but may appeal to system builders who like showing off the innards.

Verdict

It sits on the upper-end of the 240GB drives on test, beaten only by the Samsung 850 Evo in the 240GB category.

★★★★½

$279 | WWW.KINGSTON.COM

Kingston HyperX Savage 480GB

Slightly more cost-effective per gigabyte as its smaller brother.

Having two sizes of the HyperX Savage makes a good basis for comparison. Is there a difference in performance between two sizes of one drive model? The answer is yes, though it's quite small here. In fact, according to the PCMark 8 storage results, it's slightly slower by a small margin, though in the maximum throughput tests with Crystal DiskMark, the 240GB and 480GB drives performed identically, which the exception that 4k threaded writes were slower on the 480GB, and which likely explains the lower PCMark 8 score too. At $279, it's more expensive than Crucial's MX200 while coming behind it for performance.

With both drives, Kingston provides its SSD Toolbox software, which is quite basic, giving access to SMART data but not much else. HyperX Savage drivers, however, also come with an Acronis TrueImage licence for imaging and backing-up hard drives.

Verdict

Excellent performance but a little less cost-effective than the competition.

★★★★

$119 | WWW.OCZ.COM

OCZ Arc 100 240GB

Cheap and fast, what's not to like?

OCZ's ARC 100 240GB is the cheapest 240GB drive among the SSDs we looked at here. Like the Crucial BX200 and its Trion siblings, its cost per gigabyte comes in at exactly 50c/GB. It also performs almost identically to the BX200 in PCMark 8 with a score of 4,903, while its maximum throughput, according to Crystal DiskMark, was a little lower hitting 480MB/s read and 425MB/s write.

However, its 4k threaded score held up well, coming in again very close to the BX200. Indeed, among the 240GB drives, it's bested only by the Kingston HyperX Savage and Samsung 850 Evo.

Compared to its Trion 100 240GB brother with its identical price, you get a little more bang for your buck with the Arc 100.

Verdict

Good performance and an excellent price make it the top scorer in our SSD value index.

★★★★½

$119 | WWW.OCZ.COM

$239 | WWW.OCZ.COM

OCZ Trion 100 240GB

Not the fastest drive, but not expensive either.

Sharing pride of place as the equal cheapest drive in our roundup, the OCZ Trion 100 240GB is brother to the Arc 100 240GB and, while the difference is small, the ARC actually outperformed it in our PCMark 8 test, despite OCZ listing the Trion as the faster drive. Digging into the Crystal DiskMark results, however, we see the Trion scoring a very respectable 540MB/s read and 500MB/s write compared to the Arc's 480MB/s read and 425MB/s write. This goes to show that peak throughout doesn't necessarily translate to real-world performance, the type of which PCMark 8 measures, but if peak throughput is important to you, then the Trion is the better of the two.

At $0.50/GB it comes out as one of the better drives for the SSD value index, despite the fact it came last in our PCMark 8 storage results.

Verdict

Not the fastest, but it's up there in terms of bang for buck vs performance.

★★★★☆

OCZ Trion 100 480GB

Big space without a big price.

Another great comparison of the same drive model with two different sizes. Here we see the 480GB version of the Trion 100 outstrip its smaller brother by a small margin in the PCMark 8 storage rankings. This is displayed in the Crystal DiskMark scores as well, where the 480GB model reached the same peak read score of around 540MB/s but upped the write speed to 530MB/s. This was reflected in the 4k queued write tests too, where the 480GB model was approximately 100MB/s faster.

Among the 480GB and larger drives, it comes in at $0.50/GB, matching the Crucial BX200 at the same price point. However, it's outperformed by the BX200, making the Trion 100 480GB model the slowest 480GB in our test.

Verdict

As with the other OCZ drives, the 480GB scores well in the SSD value index, but the BX200 is a better buy.

★★★½☆

How we tested

All the drives were tested on a SATA 6Gbps interface in AHCI mode on Windows 10 with the stock Windows 10 SATA drivers for the chipset.

The system utilised a 4.6Ghz Core i7-3970X processor on an ASUS X79-based motherboard.

PCMark 8's extensive storage test suite was used to gauge overall performance. This runs a series of traces dealing with Microsoft Office, Adobe Creative Suite, and a selection of popular games among other tests to give an overall picture of performance in general purpose use. CrystalDiskMark was then used to measure maximum throughput — we haven't graphed these, as the results don't represent actual use, but they can be handy in gauging the efficiency of the drive's RAM and controller.

$319 | WWW.OCZ.COM

OCZ Vector 180 480GB

OCZ's flagship SSD is fast but expensive.

As the most expensive drive in our roundup by a fair margin, and with a cost per gigabyte of $0.66 on par with the Intel 535, we'd expect top-of-the-range performance and, here, the Vector 180 does not disappoint. Though bested by both the Samsung 850 Evo and Crucial BX200 in the PCMark 8 storage results, it's nonetheless a fast drive, with peak throughput in Crystal DiskMark of 550MB/s read and 530MB/s write.

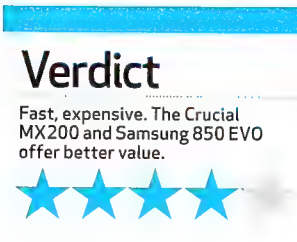
It also had the highest threaded 4k scores, beaten only by the Samsung 850 Evo.

This would be a good drive to recommend if not for the price, which places it last in our bang-for-buck graph of performance per cost per gigabyte.

Beyond this, it's otherwise a good all-rounder... if you don't mind paying the price premium for OCZ's flagship drive.

Verdict

Fast, expensive. The Crucial MX200 and Samsung 850 EVO offer better value.



$139 | WWW.SAMSUNG.COM/AU

Samsung 850 EVO 250GB

Samsung nails it again with the latest iteration of the EVO.

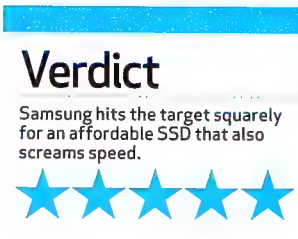
Samsung, like Intel, has made a name for itself in the SSD market with consistently high-performing SSDs that don't always cost the Earth. The 850 EVO, the little brother of the 850 Pro, comes in with a tasty $139 price tag while topping the performance ratings in the PCMark 8 storage results for our roundup. Its Crystal DiskMark scores topped 530MB/s read and 510MB/s write, a little behind some of the other drives, but it sported the fastest 4k threaded scores.

At 250GB, it also tempts with 10GB more space compared to the other drives in its category of 240GB, though it would still help to over-provision it for regular use (see Caring for an SSD opposite).

While not the cheapest cost per gigabyte, the performance pushes it into the top five of our bang-for-buck rating, making it easy to recommend as it's only $20 more expensive than the cheapest drives in our test while being the fastest.

Verdict

Samsung hits the target squarely for an affordable SSD that also screams speed.



$129 | WWW.SANDISK.COM

SanDisk Ultra II 240GB

An unremarkable but reliable all-rounder.

Sandisk make good products, but in this roundup, the Ultra II 240GB wasn't much of a standout, being second cheapest among its peers, while coming second last in performance too. This wouldn't be so bad, but its higher cost means you can get more efficient cost-per-gigabyte options with the other drives in our test.

It did, however, feature good Crystal DiskMark storage scores of 530MB/s peak read and 510MB/s write and threaded 4k results on par with most of the other drives – this just didn't translate as well in the real-world PCMark 8 tests.

It's worth noting that, even though it's near the bottom of our results, the difference between it and the top-scoring Samsung 850 EVO is just 120 points, showing that any SSD is a huge performance upgrade for a machine.

Verdict

Not a bad drive but the OCZ Arc is both faster and cheaper, and the Samsung 850 Evo is only $10 more (give or take your price shopping).

Caring for an SSD

All modern SSDs come with TRIM by default, and as long as you're using Windows 8/8.1, Windows 10 or a recent Linux distribution, TRIM commands should be automatically sent when files are deleted. This ensures maximum write performance over time, as without TRIM, write performance suffers as a drive becomes full.

That said, you can force TRIM a drive in both Windows and Linux to ensure it's operating in tip-top condition:

- In Windows right-click on a drive in Explorer and select Properties > Tools > Optimize. Windows will detect drives that are SSDs and issue TRIM commands instead of defragmentation.
- In Linux, open a terminal and simply run: `sudo fstrim -v`. The '-v' switch means verbose, and will report how many sectors were TRIMmed.

You can also help ensure longevity for a drive by over-provisioning it when you first set it up. This simply means that, when you make partitions, to not allocate the whole free drive space. For example, making a 450GB partition on a 480GB drive. You may read various rules of thumb for this online, ranging from 10% to 20% of the drive space, but ultimately, you need to partition as you see fit for best use of the drive. Note also that some drives come over-provisioned already — this is why you see, for example, a 240GB drive when, in fact, just as with your system memory, the chips used in an SSD are a square of two, meaning the drive actually has 256GB of space, but you're forcibly limited to a value smaller than this. However, while this built-in over-provisioning is in place, it's also often used as a 'scratch' area for the firmware to move data around, so it still helps to not allocate the entire free space to partitions.

> "SSD manufacturers often release firmware updates to fix bugs or improve performance. It's well worth updating the firmware of an SSD, but note this often erases the drive, meaning you have to do it before you install anything on it."

Finally, SSD manufacturers often release firmware updates to fix bugs or improve performance. It's well worth updating the firmware of an SSD, but note this often erases the drive, meaning you have to do it before you install anything on it. Fortunately, many manufacturers have their own SSD management software that makes it easy to update the firmware, you just may need to plug it into another machine where you can run the software and update the drive.

SSD PERFORMANCE – PCMARK 8 STORAGE TEST

SAMSUNG 850 EVO 250GB	CRUCIAL MX200 500GB	OCZ VECTOR 180 480GB	KINGSTON HYPERX SAVAGE 240GB	KINGSTON HYPERX SAVAGE 480GB	OCZ ARC 100 240GB	CRUCIAL BX200 480GB	INTEL SSD 535 240GB	OCZ TRION 100 480GB	SANDISK ULTRA II 240GB	OCZ TRION 100 240GB
4973	4967	4951	4926	4917	4903	4900	4879	4873	4842	4834

SSDS - COST PER GIGABYTE

OCZ ARC 100 240GB	CRUCIAL BX200 480GB	OCZ TRION 100 240GB	OCZ TRION 100 480GB	SAMSUNG 850 EVO 250GB	SANDISK ULTRA II 240GB	CRUCIAL MX200 500GB	KINGSTON HYPERX SAVAGE 480GB	KINGSTON HYPERX SAVAGE 240GB	INTEL SSD 535 240GB	OCZ VECTOR 180 480GB
$0.50	$0.50	$0.50	$0.50	$0.54	$0.54	$0.55	$0.58	$0.62	$0.66	$0.66

SSD VALUE INDEX

OCZ ARC 100 240GB	CRUCIAL BX200 480GB	OCZ TRION 100 480GB	OCZ TRION 100 240GB	SAMSUNG 850 EVO 250GB	CRUCIAL MX200 500GB	SANDISK ULTRA II 240GB	KINGSTON HYPERX SAVAGE 480GB	KINGSTON HYPERX SAVAGE 240GB	INTEL SERIES 535 240GB	OCZ VECTOR 180 480GB
99	98	98	97	92	90	90	85	79	74	74

(PCMARK PERFORMANCE VS COST PER GIGABYTE, HIGHER IS BETTER)

PSUs without the high price

New, more power-efficient Intel CPUs allow for smaller power supply units. Darren Yates rounds up eight of the latest affordable PSUs.

Intel's new Skylake CPUs are looking like the best excuse in ages to upgrade your PC. But if you are planning a new build, make sure you give plenty of thought to the most important component of all – your system's power supply unit (PSU).

Improved manufacturing means the latest CPUs and graphics cards need considerably less power than generations past, enabling the choice of smaller and cheaper PSUs, so we sent out the call to PSU suppliers for their more affordable models to see what's available.

FORGET THE NAME ON THE BOX

We're all working to budgets these days, but it's a mistake to make price your sole selection criteria. The PSU is the most important PC component – without it, you're going nowhere. What's more, a poor-quality PSU can fail when you least expect it and possibly take out the rest of the system along with it.

We saw several improvements this roundup, from greater use of modular cabling, better build and improved component quality, but most noticeable to us was the increase in low/zero-noise fan-cooling, offering the possibility of high-performance gaming and home theatre use from the one box.

While you'll find a mix of models with anchored/'native', semi-modular and fully modular cable management, we think semi-modular PSUs make the right compromise between cable count and cost for most users. Old-style anchored PSUs can be good value but choose carefully, as they tend to feature in older less-efficient models.

But if there's one bit of advice we can give, it's forget the brand-name on the box. Find out the company that actually manufactured your PSU and you'll go a long way to knowing just how good it really is.

HOW WE TESTED

Each PSU was plugged into a Core i7-2600K desktop with a GeForce GTX 480 graphics card and tested when powered off, sitting on Windows desktop and demo gaming at 1080p. Tests were carried out using a PowerMate Lite 10-amp AC power meter, measuring actual power (watts), apparent power (volts-amps or 'VA'), AC current and power factor (PF).

POWER SUPPLY UNITS - HOW THEY COMPARE

MODEL	COOLER MASTER V750	CORSAIR RM650X	FRACTAL DESIGN EDISON M 550W	FSP AURUM CM 650W	FSP RAIDER 750W	HYDANCE HY-600CT ACTIVE PFC (C6)	SEASONIC SSR-650RM ACTIVE PFC F3	THERMALTAKE SP-650P
PRICE	$195	$175	$145	$139	$135	$99	$165	$125
SPECIFICATIONS								
MANUFACTURER OEM	ENHANCE	CWT	SEASONIC	FSP	FSP	EPE/SEASONIC	SEASONIC	CWT
MAX. TOTAL OUTPUT POWER (WATTS)	750	650	550	650	750	600	650	650
MAX. CURRENT (3.3V) (AMPS)	25	25	20	26	26	24	20	24
MAX. CURRENT (5V) (AMPS)	22	25	20	26	26	24	20	24
MAX. CURRENT (12V) (AMPS)	62	54	45	50*	60	40*	54	52
NUMBER OF +12V RAILS	1	1	1	4	1	4	1	1
MAX. CURRENT (-12V) (AMPS)	0.3	0.8	0.3	0.5	0.5	0.3	0.3	0.5
MAX. CURRENT (5VSB) (AMPS)	2.5	3	2.5	3.5	2.5	2.5	2.5	3
MAX. POWER OUTPUT (3.3V/5V) (WATTS)	120	130	100	150	170	140	100	120
MAX. POWER OUTPUT (12V) (WATTS)	744	648	540	600	720	480	648	624
INPUT VOLTAGE RANGE (VOLTS)	100-240	100-240	N/A	90-264	100-240	200-230	90-264	100-240
INPUT AC FREQUENCY RANGE (HZ)	50-60	47-63	N/A	47-63	50-60	50-60	50-60	47-63
80-PLUS EFFICIENCY RATING	GOLD	GOLD	GOLD	GOLD	SILVER	BRONZE	GOLD	BRONZE
FEATURES								
IEC 60320 POWER SOCKET TYPE	C14	C14	C14	C14	C14	C14	C14	C14
HARD-WIRED POWER SWITCH^	YES	YES	YES	YES	YES	YES	YES	YES
CABLE TYPE	MODULAR	MODULAR	SEMI-MODULAR	SEMI-MODULAR	ANCHORED	ANCHORED	SEMI-MODULAR	ANCHORED
TESTS - POWER CONSUMPTION								
- OFF (WATTS/VA)	0.51/43.1	0.37/36.7	0.39/15.17	0.39/13.03	0.44/21.6	0.52/19.3	0.35/19.2	0.39/39.1
- WINDOWS DESKTOP (WATTS/VA)	98.3/123.7	94.6/115.4	102.1/108.8	99.7/111.5	101.2/114.3	103.5/112.0	101.8/119.0	101.3/120.2
- DIRT 2 (PEAK WATTS/VA)	322.6/347.4	329.0/336.3	326.0/328.3	327.4/334.8	342.0/352.1	350.2/356.1	339.3/345.5	333.9/347.9
PEAK POWER FACTOR READING	0.928	0.978	0.992	0.977	0.971	0.983	0.982	0.959

You can read more about 80-Plus certification at http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx.
** indicates maximum total combined 12V rail current.*
^ switch does not disconnect AC mains from PSU.

$195 | WWW.COOLERMASTER.COM

Cooler Master V750

Fully modular, but more than most users will need.

Cooler Master sourced the previous-generation V700 from Seasonic, but this new fully modular 750W OEM'd from Enhance Electronics is also nicely put together. With up to 62 amps available from a single 12VDC voltage rail, you won't be lacking for GPU headroom here.

Its active power factor correction (APFC) results weren't the best on our testing, needing 43 volts-amps (43VA) of apparent power just to turn over the 0.51W required when powered off. Pushing it to 320W output on 1080p gaming improved the power factor to 0.928, but only enough to bring up the rear of the field. The V750's APFC should improve the harder you push the PSU, as with high-capacity models.

On the credit side of the ledger, the V750 offers excellent connectivity with eight SATA outputs and four 6+2-pin PCI-E connectors. If you can keep the power draw to under around 350W, the Silencio FP fan should sit at about 600RPM. While not quite 'silent', it's still a decent effort for a PSU of this capacity.

It's fully modular, right down to the ATX 24-pin motherboard cable, but given full modularity often loads up the price, it's not surprising this was the most expensive unit we saw. Overall conversion efficiency at better than 90% is good enough to gain Gold 80-Plus status and it delivers 'over-everything' (over-voltage, power, current and temp) protection. The combined 120W limit on the 3.3V/5V rails is a bit low given overall capacity, but not seriously so. More power than most users will need.

Verdict

Fully modular, delivers low-noise output, all Japanese capacitors, but you pay for it.

★★★★½

$175 | WWW.CORSAIR.COM

Corsair RM650x

Fully modular, quiet and designed for tough environments.

Corsair's brand new RM650x was the only other fully modular PSU we saw in this roundup beyond Cooler Master's V750, but at $175 for 650W, it was also up there for price. Like many brands, Corsair doesn't make its own PSUs, but uses a range of OEMs from Seasonic to Great Wall. The RM650x is sourced from Channel Well Technology (CWT) and comes backed with an extended seven-year warranty.

We think it's a step up from Corsair's RM series, which copped a bit of flak for some of its component choices. However, with an extra two years' warranty, that looks to have been rectified, with all Japanese capacitors on-board. It's a stylish design, fully modular with flat cables and a Gold 80-Plus rating for efficiency.

There are some neat technical features here, too. For starters, it's designed to deliver full power at up to 50°C, ideal for extended high-performance gaming. The fan is also a larger 135mm size, but if you can keep your system load to below 260W and room temperature below the standard 25°C, the fan shouldn't even power up.

Like most PSUs of its size, it offers eight SATA and four 6+2-pin PCI-E connectors. Surprisingly, it also comes with two mini four-pin floppy drive power adapters.

While the new seven-year warranty alone makes this a step up from the RM series, it does lack the RM's Corsair Link capability, which, for extra cost, enables you to monitor power flow from the Windows desktop. Still, overall, the RM650x is nicely done.

Verdict

One of the best CWT-built PSUs we've seen: quiet, well-connected, but just a little pricey.

★★★★½

$145 | WWW.FRACTAL-DESIGN.COM

Fractal Design Edison M 550W

Only 550W but more connections than a race horse.

You probably know of Fractal Design through its excellent PC cases, but it also now pushes its own brand of PSUs, albeit OEM'd from other suppliers. The Edison M range come from Seasonic's G-series semi-modular platform and was one of the best models we saw, despite being a little pricey on a dollar-per-watt basis.

It's another Gold 80-plus-rated PSU, which means at least 90% efficiency and delivered an excellent 0.992 power factor on our 1080p gaming test. It uses semi-modular cable management, which we think is the right way to go in terms of compromising price versus function.

The anchored cabling includes motherboard (ATX), CPU (ATX12V) and two 6+2-pin PCI-E connectors, but you can also have another four 6+2-pin connectors on the modular cabling, for six in total. Impressive. As for SATA, the three modular cables give you up to eight power connectors, so there's definitely no shortage. Not even Seasonic's own G-650 is that generous. Compare it to the Thermaltake SP-650P, which offers 100 extra watts of power, but only two PCI-E connectors.

The thing to watch here will be overloading the PSU with too many graphics cards. However, quality Japanese capacitors, tight voltage tolerances and over-everything protection (over-voltage, power, current and temp) should make this one tough PSU.

For the output power on offer, you are paying a bit of a premium, but reports are this is one of the best of its capacity for voltage regulation.

Verdict

Built by Seasonic and jam-packed with connection options, it's unlikely you'll go wrong here.

★★★★½

$139 | WWW.FSPLIFESTYLE.COM

FSP Aurum CM 650W (AU-650M)

Quiet, reasonable value and better than the FSP Raider 750.

The two FSP PSUs we tested for this roundup give you a good guide on how output power and features can be traded at a given price. Both the AU-650M and its more powerful RA750 sibling sell for around the $140 mark in Australia, but output power shouldn't be your primary criteria.

The AU-650M delivers Gold-grade 80-Plus efficiency and its APFC pushes power factor to just shy of 0.98. It's semi-modular, giving you ATX (24-pin) and ATX12V motherboard connectors, plus two 6+2-pin PCI-E outputs on anchored cabling. The modular options add in another two PCI-E connectors as well as up to eight SATA connectors.

It was only one of two PSUs we saw featuring multiple 12V rails and there aren't many of them around, particularly among the name brands and bigger OEMs. Given it's a 50-watter, the fact it will output up to 600W combined from all four 12V rails makes this a better choice than the Hydance HY-600CT and its low 480W limit. Unlike the HY-600CT, all four 12V rails have the same 15-amp current rating, limited to 50-amps combined. This one delivers the highest 5VSB (standby) current rating we saw at 3.5 amps.

Fluid dynamic bearing (FDB) fans are the latest selling point in PSUs and the AU-650M doesn't miss out, helping to reduce overall fan noise and extend lifespan. We weren't able to test it, but there are some concerns online about aspects of voltage regulation, so we're cautious about putting this in the same class as Seasonic's G-series.

Verdict

Having multiple 12V rails is unusual these days, but it's actually done fairly well here.

★★★★☆

$132 | WWW.FSPLIFESTYLE.COM

FSP Raider 750W (RA750)

Relatively cheap, but better models elsewhere.

Like Seasonic, FSP makes its own PSUs and OEMs them to a number of other brands. The RA750 goes under the FSP brand and is one of the cheaper 750-watters on the market, but loses a bit when you start comparing features outside of the raw watts per buck.

Efficiency is rated at 80-Plus Silver, so between 88% and 90%. FSP rates the PF ratio as better than 99% (0.99). On 1080p gaming at 342W peak, we measured 0.971, so not far off and likely to improve the greater loads.

It has to be said, though, that cable management isn't the Raider's strong suite. It's a completely anchored design, but there's minimal sleeving and although you do get decent cable length for larger case builds, we wouldn't choose this for compact ITX systems.

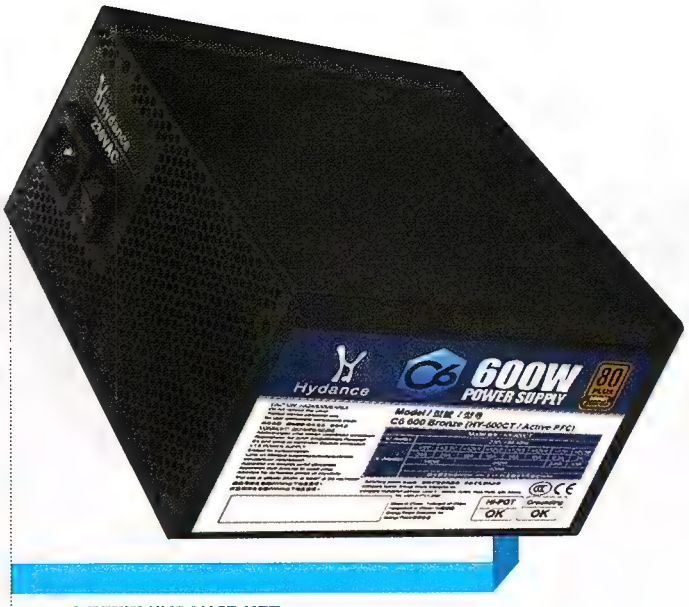
Still, it features a single 12V rail rated for up to 60 amps and with four 6+2-pin PCI-E connectors, it should power most modern dual-card builds fairly comfortably. Its protection level is quite good with over-voltage/current/power protection, but thermal protection is a notable omission.

Still, the fact it's rated at least 80-Plus Silver is a plus in itself, particularly given there are cheaper 750W units out there that offer nothing in that regard and if you're on a tight budget, there are worse options available. But be sure you actually need 750 watts before you buy this one. The 650W Aurum CM 650W is a better option at around the same street price.

Verdict

Lots of watts for comparatively few bucks, but definitely entry-level all-round.

★★★☆☆



$99 | WWW.HYDANCE.NET

Hydance HY-600CT Active PFC

Seasonic design for under $100?

Hydance is the brand-name of Energy Power Enterprise, which itself appears to be a subsidiary of PSU powerhouse Seasonic. But whether this HY-600CT is actually made by Seasonic or just a Seasonic design made by someone else, we're not sure. Either way, the sub-$100 price tag made this the cheapest model we saw. Cable management is fully anchored and a little less generous on the cable lengths compared with other similar offerings.

Regardless of its origins, we don't think this is a recent design; for instead of the current norm of a single big 12VDC supply rail, the HY-600CT has four, but only the 12V1 and 12V2 rails deliver a maximum 18 amps. 12V3 and 12V4 only output 16 and 15 amps, respectively. The greater issue is the combined power maximum output, which, at only 480W, is the lowest contender by a considerable margin and low for a 600W PSU. When you factor that in, $99 makes sense.

In testing, the active-power factor correction delivered better than 0.9 power factor on Windows desktop, reaching 0.983 on 1080p gaming while its 80-Plus Bronze rating gives it 82–88% power efficiency.

You only get two 6+2-pin PCI-E connectors, four SATA and three Molex connectors. Not generous, but enough for most basic mid-level gaming builds.

Bottom line, the low 480W combined power maximum rating makes us wary of pushing this as hard as other 600W rated PSUs, which realistically means, even with a three-year warranty, it would struggle to make our must-see list.

Verdict

The cheapest PSU of the roundup, but low multi-rail output limit has us looking elsewhere.

★★★☆☆

$149 | WWW.SEASONIC.COM

Seasonic G-650

Simple, really — buy this one.

If there's one PSU brand most PC builders will speak of in hushed, reverent tones, it's Seasonic. It's the brand other brands choose to make their top-drawer luxury models. The G-series might be close to Seasonic's entry-level range, but you'll still pay around $165 for this 650W G-650, so they don't come cheap. That said, you're getting one of the better-built PSUs on the market, with 80-Plus Gold efficiency rating and upwards of 0.98 power factor performance.

In testing, the Fractal Design unit showed slightly better power factor performance, which you'd expect with a smaller-capacity PSU. As for connection options, it matches the Fractal Design version with eight SATA connectors, but only provides four 6+2-pin PCI-E connectors. Still, that's enough for a decent dual-card gaming setup (note, the 550W version only has two).

It's loaded with over-protection (over-voltage, current, power and temperature) as well as short-circuit protection, making it one of the toughest PSUs you'll find. Active fan control will keep noise down and it's backed by a five-year warranty.

We also like the G-650's semi-modular design. Modularising the main motherboard (ATX/ATX12V) connections when you have to use them anyway in our view adds more to cost than benefits. Keeping modular the optional ones we think is the right mix for price, stability and reliability.

Seasonic is pretty much the Rolls Royce of PC PSU makers and while there are cheaper options around, you won't find too many better.

Verdict

The G-series is entry-level, but no-one ever regrets buying a Seasonic PSU.

★★★★½

$125 | WWW.THERMALTAKE.COM.AU

Thermaltake Smart 650W

Reasonably priced, but not for serious gamers.

Thermaltake sent us the cheapest of the four 650W models we saw with this Smart 650W. It's another unit made by CWT and on the street for around $125. It's only 'bronze' 80-Plus-grade in terms of efficiency (82–88%), although in testing, its active power factor correction gets up to 0.96 when you're pushing it on 1080p gameplay. Turn the power off, though, and the SP-650P consumes just 0.4 watts but requires 39 volt-amps (39VA) apparent power — only Cooler Master's Smart V750 needed more.

All cables are anchored but the connection options probably tell you the expected clientele for this unit with six SATA and only two 6+2-pin PCI-E power connectors — and that's despite a 12-volt rail claimed to be able to deliver up to 54 amps. Sadly, it's not going to be the choice for multi-card gaming.

Interestingly, Thermaltake rates this 650-watt PSU to deliver a 'peak' output of up to 780W, but does not specify for how long. Yet, with only two PCI-E connectors, we're not quite sure how you'd get up to 780W these days, in any case.

Frankly, if your budget won't quite spring the extra $40 for a Seasonic, save up. This is clearly aimed at the budget mainstream PC gamer but even then, they probably won't need a 650W PSU anyway. For example, Nvidia's GeForce GTX 980 is happy playing with a 500W PSU, in which case, we would stop drinking coffee for a week, save the extra $20 and choose the Fractal Design Edison M 550W instead.

Verdict

Plenty of power for the price, but only two PCI-E connectors limits your gaming options.

★★★½

crucial by Micron

ENJOY YOUR COMPUTER AGAIN.

CRUCIAL® BX200 SSD

- Significantly faster than a typical hard drive
- More durable than a typical hard drive
- More energy efficient than a typical hard drive

AVAILABLE THROUGH OUR AUTHORISED RETAILERS

Umart online | PLE Computers | mwave.com.au | scorptec computers

©2015 Micron Technology, Inc All rights reserved. Information is subject to change without notice. Micron and the Micron logo are registered trademarks of Micron Technology, Inc. Crucial, the Crucial logo, and The memory & storage experts are trademarks or registered trademarks of Micron Technology, Inc. All other trademarks and service marks are the property of their respective owners. Products and specifications are subject to change without notice. Neither Crucial nor Micron Technology is responsible for omissions or errors in typography or photography.

how to

» QUICK TIPS

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

HARDWARE

BOOTS 'N' ALL

I've been trying to find out how hard disk lifespan is determined. I've read on several websites that it depends on the number of times the PC is booted. Does this mean turned off and on? Or does restarting from the Start menu count as well? Is it better to leave the PC on all the time and only reboot when something crashes or for updates?
Mark Ogbourne

I'm not sure which websites these are but you need to update your bookmarks because this is – well, not wrong exactly – but somewhere between an oversimplification and a misunderstanding. The SMART health monitoring software on your hard disk does track the number of reboots, but this is just part of the way that it estimates wear and tear on the drive. There is no predetermined lifebar for your hard disk that shrinks by a fixed amount every time you reboot. And manufacturers aren't consistent about what they record anyway. Some count each soft boot, others only count the power on/off cycles. Whether you turn off your PC at night depends on your own particular cocktail of neuroses.

Some people find the idea of wasting a few watts of standby electricity totally unbearable. Others are brought to a rolling boil by the extra seconds it takes to power on a PC, compared with waking it from sleep. Both of these problems are pretty much rendered trivial by switching from a hard disk to an SSD, because these don't need to use electricity spinning themselves up and down, and reduce boot times to just a few seconds. Ironically SSDs are completely different to hard disks in the way that they measure their lifespan, but exactly the same as hard disks in as much as you don't need to worry about it either. The best way to protect your hard disk by backing it up, not by using it less.
Luis Villazon

HARDWARE

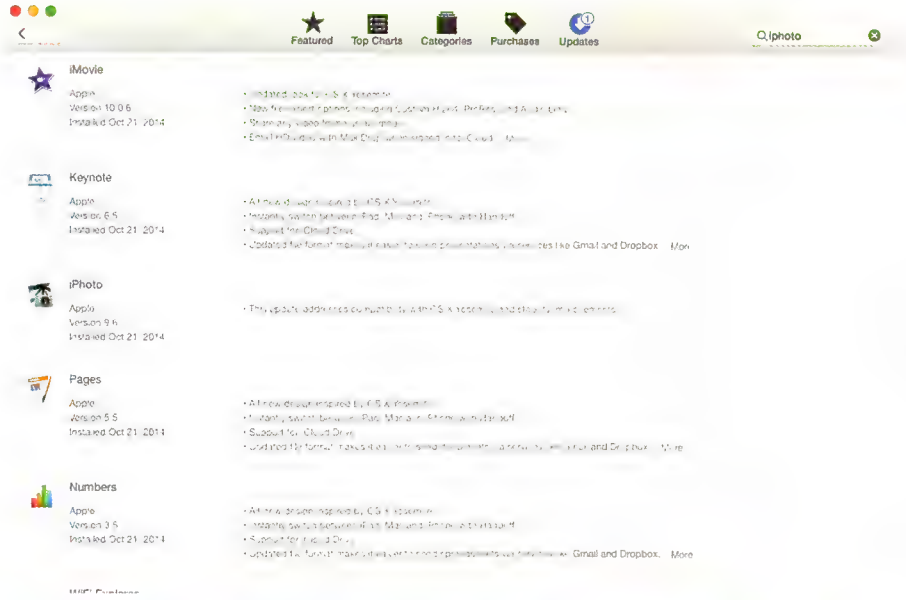
SSDS IN RAID

I recently replaced my four 300GB Western Digital Raptors in RAID 0 with two Samsung 850 EVO SSDs, also in RAID 0. My C:\ drive is a 256GB Samsung 840 Pro on which Windows 8.1 Pro resides. The EVOs are drive D:\. Samsung's Magician software came bundled with the EVOs. But when I use it, the program only sees the 840 Pro. There's no D:\ drive at all. Now, when I go into Windows's Device Manager, under Disk Drives, I see the 840 Pro. However, the other drive is listed as an Intel RAID 0 volume. Why can't the striped volume be identified as the 850 EVO SSDs? Is there a way to get them properly identified by Windows, or seen by Magician? Is this going to hurt the drives when Windows defragments them? They are fast; the performance seems to be there. I have tried to update their drivers, but Windows says that they're already up to date.
Ron Shibler

To manage RAIDed SSDs, you'll need software from the maker of the RAID controller (like Intel's Rapid Storage Technology drivers), not the drives.

Unfortunately, Samsung's Magician software will not recognize SSDs in RAID, as you've observed. However, consider installing Intel's Rapid Storage Technology RAID driver from tinyurl.com/apc423-intel, which does support your drives in a striped array.
APC team

How long will your hard drive last? That probably isn't the question you need to ask.



If the iLife apps aren't installed under your Apple ID, you can't update them using the App Store.

"Your daughter can give you the Mac hardware, but she can't actually transfer the apps tied to her Apple ID."

MAC

INHERITING A MACBOOK

I have a MacBook, which I got when my daughter upgraded. Everything works fine and I'm the sole user. My only problem is with the App Store. When an update is selected, it asks for an Apple ID password, but with my daughter's ID, which is greyed out and can't be changed. Is there a way to change this to my own Apple ID, or do I have to reset the MacBook?

John R. Gordon

The procedure for hand-me-down laptops is the same as for other secondhand Macs: they need to be erased and reinstalled using Internet Recovery mode. This is because OS X is irrevocably tied to the Apple ID that was used to install it. You'll be able to install the operating system this way but any other apps from the App Store are tied to that Apple ID as well and you have no legal title to them. This doesn't just apply to third-party apps, it includes the iLife apps (iPhoto, iMovie and GarageBand). These are bundled for free with a new Mac, but they aren't actually part of OS X. Your daughter can give you the Mac hardware, but she can't actually transfer the apps tied to her Apple ID.

After you have reset the MacBook, you can sign in to the App Store and download these apps again. GarageBand is free but the other two cost $22.99 each. Or you could leave the MacBook tied to her Apple ID and just get her to type in her password whenever you need to update.

Luis Villazon

WINDOWS

PERMISSION NOT REQUIRED

Is there a way to get rid of those messages that tell me I need to provide administrator permission every time I copy files and folders from a USB stick? I'm sure this didn't used to happen, but ever since I upgraded to Windows 8.1, my PC never seems to stop nagging me!

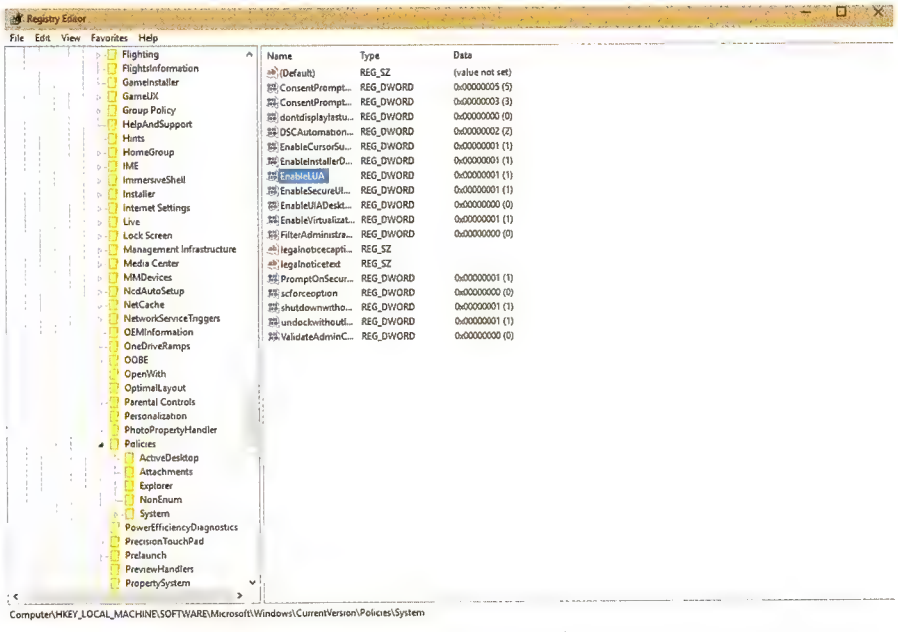
Peter Biggs

This is part of User Account Control, or UAC, which is designed to stop malware from writing or deleting files without your explicit say-so. You can turn off UAC by editing the 'HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\System' key in the registry and changing EnableLUA to '0'. But don't do this. Running Windows without UAC is like taking the battery out of your smoke alarm. You tell yourself you'll put it back after you have finished making toast. And then four weeks later the house burns down in the middle of the night. And you with it. A better option is to make your user account the owner of the destination folder. That is normally enough to quieten UAC messages for that specific folder, but it still leaves UAC protecting you for everything else. See the below step-by-step guide for a more detailed explanation of how to do this. It's also worth noting that overzealous antivirus programs can trigger more of these warnings than usual. Avast! File System Shield does this, for example. In the latter, you can turn off the File Shield without disabling everything else by clicking 'Settings > Active Protection > File System Shield > Off'.

But getting back to that guide for taking ownership:

1 Being the administrator user in Windows doesn't give you permission to make modifications to absolutely any file. For some system files, and files created on external media by other users, you can still find yourself locked out. That's because you're not the owner of these files.

2 In Windows 8, admin users can take ownership of a file or folder by right-clicking and choosing



You can dive into your registry to ditch UAC, but we don't recommend it.

If you're building a high-performance PC, do yourself a favour and invest in a good case to house it in.

"...if you're in the market for a $1,200 processor and motherboard combination don't waste your time trawling garage sales."

'Properties'. Then, on the 'Security' tab, click 'Advanced'. Where it says "Unable to display current owner", click 'Change'. Enter your Windows login name and click 'OK'.

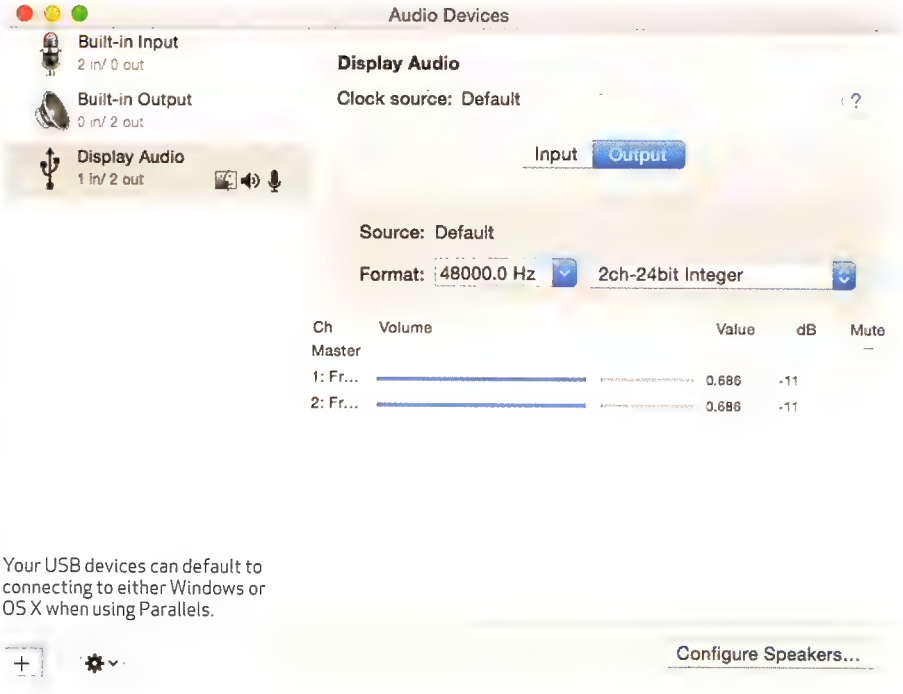
3 But that's quite a lot of flap to be going through every time you want to be taking ownership of one object, so if you find yourself doing it a lot, you'll want a shortcut. You can download a set of registry hacks to add this to the context menu by heading to **bit.ly/1Jmjw2L**.

4 You finally need to double-click 'InstallTakeOwnership.reg' (or open it in Notepad first, to check the registry keys it will modify). To take ownership of any file, you can just right-click and choose 'Take Ownership'. You'll normally still need admin rights to do this though.
Luis Villazon

MAC
DEFECTING FROM WINDOWS

My iMac runs Mavericks, and I run Windows in a virtual machine using Parallels. Previously, I set my 1TB external drive to connect to Windows by default. I now want it to default to connecting to OS X, but I can't work out how to change this.
Steve Mapstone

It's very slightly different between versions of Parallels, but if you open Parallels' preferences and click the Devices or USB tab, you'll see every device for which Parallels remembers your preference. Select your drive in this list and press the minus button to clear its setting. Ensure "Ask me what to do" is chosen under "When a new external device is detected", above, and Parallels will ask what to do when you next connect the drive.
Luis Villazon



Your USB devices can default to connecting to either Windows or OS X when using Parallels.

HARDWARE
SALVAGING OLD PARTS

I've never built a PC, but would like to experience the feeling of accomplishment that I'm sure comes from such a project. After hitting up garage sales this past spring, I picked up a couple of used machines (an old Compaq and an Acer box). Are there motherboards that would work as the foundation for a practical system, given my lack of experience and old hardware? I'm not looking to game. Rather, I just want to bring new life to an old PC. I could use a system that supports TV tuning and video editing. I don't even need much storage. However, a motherboard able to accommodate a CPU upgrade would be nice. I was thinking about going with an X99 motherboard and Intel's Core i7-5930K. If that's overkill for an old Acer case, could you set me straight?
Jo Shim

There are plenty of ways to compromise and save money as you collect the pieces for your first PC. But if you're in the market for a $1,200 processor and motherboard combination (that's before getting into the memory, graphics, and storage to balance those high-end parts), don't waste your time trawling garage sales. It's not that we have has something against recycling decrepit hardware – we're simply trying to save you the trouble of getting elbows-deep into a chassis that might not even give your Core i7 ample airflow, only to discover it also uses non-standard dimensions that are unfriendly to modern ATX power supplies and motherboards. With so many snazzy cases selling for less than $150, give those high-end parts a home you'll be proud of.
APC team

Could viruses be hiding in firmware updates? It's technically possible, but unlikely.

SECURITY

MYSTERIOUSLY CHANGED PASSWORD

I recently had an email advising me that one of my online passwords had been changed, even though I hadn't changed it myself! When I tried to log in, it no longer accepted my password and I had to spend a long time exchanging phone calls and emails with customer services to get my account reset. The website in question was unable to tell me how this happened, and seemed to think it was someone in my family, which it wasn't. Do you have any ideas about how hackers could have done this? How can I protect myself?
Anders Blumgardener

They probably just guessed the answer to your secret question. The other easy way to hack someone is to trick them into installing a keylogger on their PC. A keylogger is a little program that invisibly records every keystroke you make on your keyboard and then sends it to a hacker, who looks through this file for a likely looking password, typed just after you entered "www.amazon.com", for example. But if you'd been hacked with a keylogger, you'd probably have seen a lot more than just one lone website hacked. And installing a keylogger requires physical access to your PC, or tricking you into downloading and executing a trojan virus.

Guessing most people's secret question, on the other hand, is usually very easy. Your mother's maiden name is a matter of public record, for example, and things like your pet's name or your favourite movie can often be guessed by snooping through your Facebook page. Hackers can easily look at public profiles, which often shows the school people went to, and then create a fake profile posing as someone from that school. Then, they make a friend request from that profile, which many people will accept out of curiosity. If you insist on creating your own passwords (rather than using a dedicate password manager like LastPass), the solution is to treat the 'answer' to your secret question as just another password. What is your mother's maiden name? Why, it's octogon294 br@vura of course. Write that down somewhere safe and you have a secure way to recover your password. Secret questions aren't used much anymore, precisely because they aren't very secure. Most of the big sites will only send password reset links to email addresses that have previously been associated with your account.
Luis Villazon

SECURITY

THE NEXT BIG THREAT?

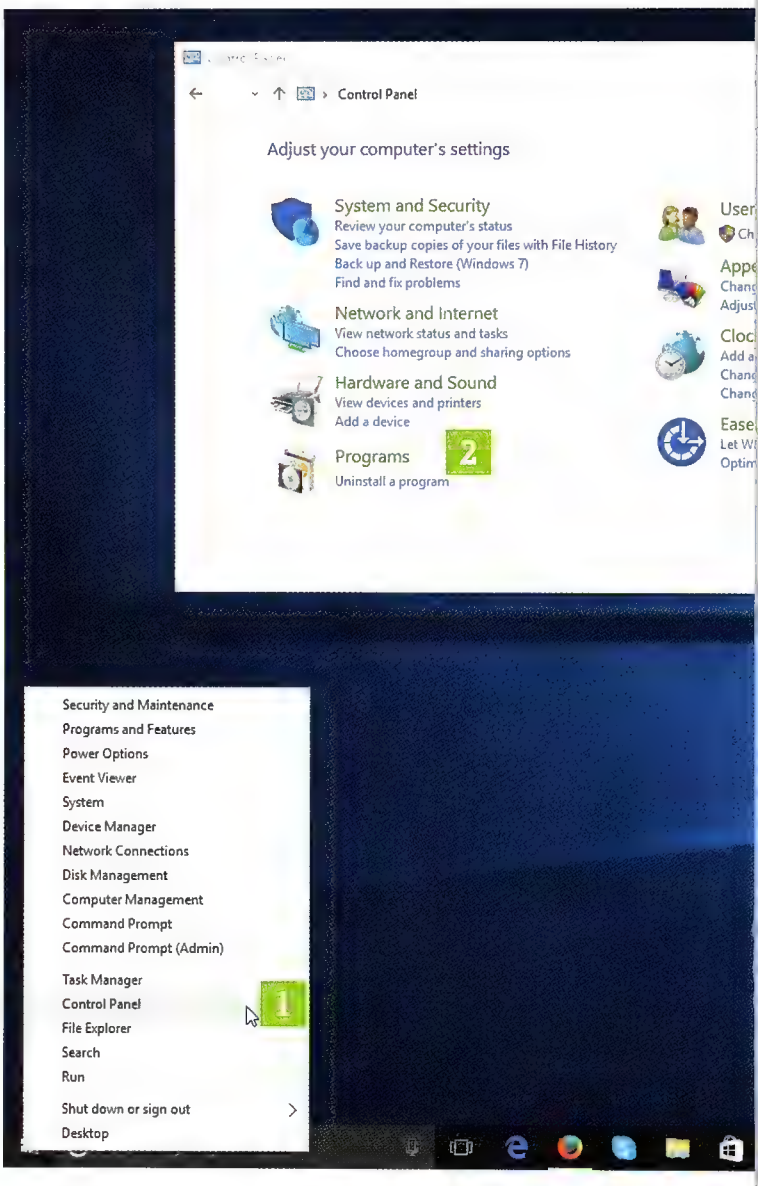
I often see advice on hardware forums advising me to download this or that firmware update to upgrade a device to the latest version. From what I understand, firmware is just a special kind of executable that runs inside my drive controller or graphics card or whatever. So what is to stop this executable from becoming infected by a virus? If my hardware gets infected, will my antivirus program detect it?
Bryn Clewes

There's nothing in principle that prevents firmware from being infected with malware. Firmware is executable code that is run by the embedded processor on a device. If you change the instructions in that firmware, you could make the hardware do something it wasn't meant to. But a virus is a specialised kind of malware that spreads itself from one PC to the next and that's only possible from certain hardware devices. Your graphics card only has hardware to allow it to write to video memory; it can't infect another PC because it has no access to the network card or disk drives. Theoretically the firmware in a network card or a drive controller could do this but it would be technically very difficult to do. In the 1990s we had file viruses that were capable of encrypting your BIOS. That's a kind of firmware virus, I suppose, but the virus didn't live in the BIOS firmware itself – it just used the BIOS as a sort of digital hostage.

So it might happen one day, but at the moment I don't know of any virus or worm that resides within the firmware of a hardware device. However, most firmware is installed by downloading an installer executable and that installer absolutely can be infected. If you are updating firmware, only download it from the original manufacturer's website. And if you have any doubts, upload the file to **virustotal.com** first and get it scanned.
Luis Villazon

Get to grips with the Windows 10 Control Panel

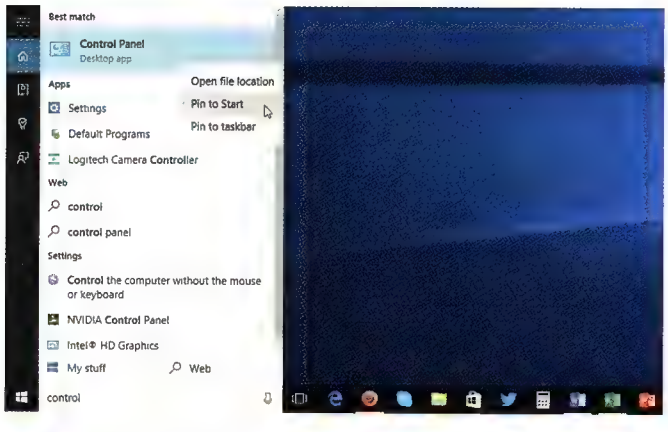
Discover how to bypass Settings to quickly access key Control Panel applets in Windows 10.



Despite first appearances, Windows 10 hasn't killed off the Control Panel. Although you're strongly pushed towards the new – and admittedly sometimes improved – Settings dialogue first seen in Windows 8, the old Control Panel still lurks behind the scenes, giving you access to just about every system setting imaginable. And while a fair bit of its functionality has now been incorporated into Settings, there are still plenty of times when you'll need to access the Control Panel to tweak certain parts of your PC.

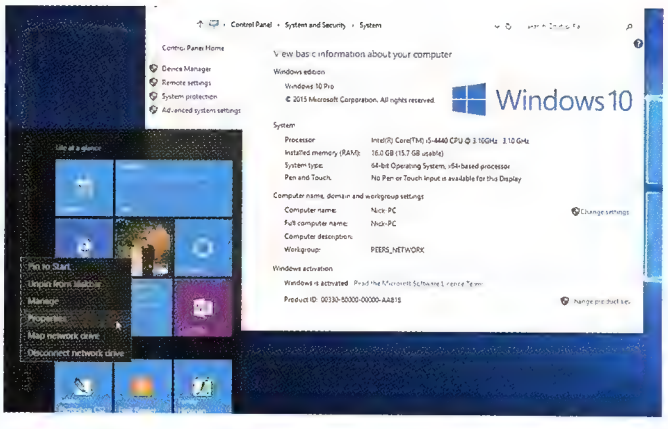
In some cases, direct links to some Control Panel applets can be found in Settings itself – look for references to 'advanced settings' to access them. However, in this tutorial, we'll focus on revealing key settings that are hidden behind the scenes. Read on to find out more about them, plus gain that all-important access.

How to use Control Panel



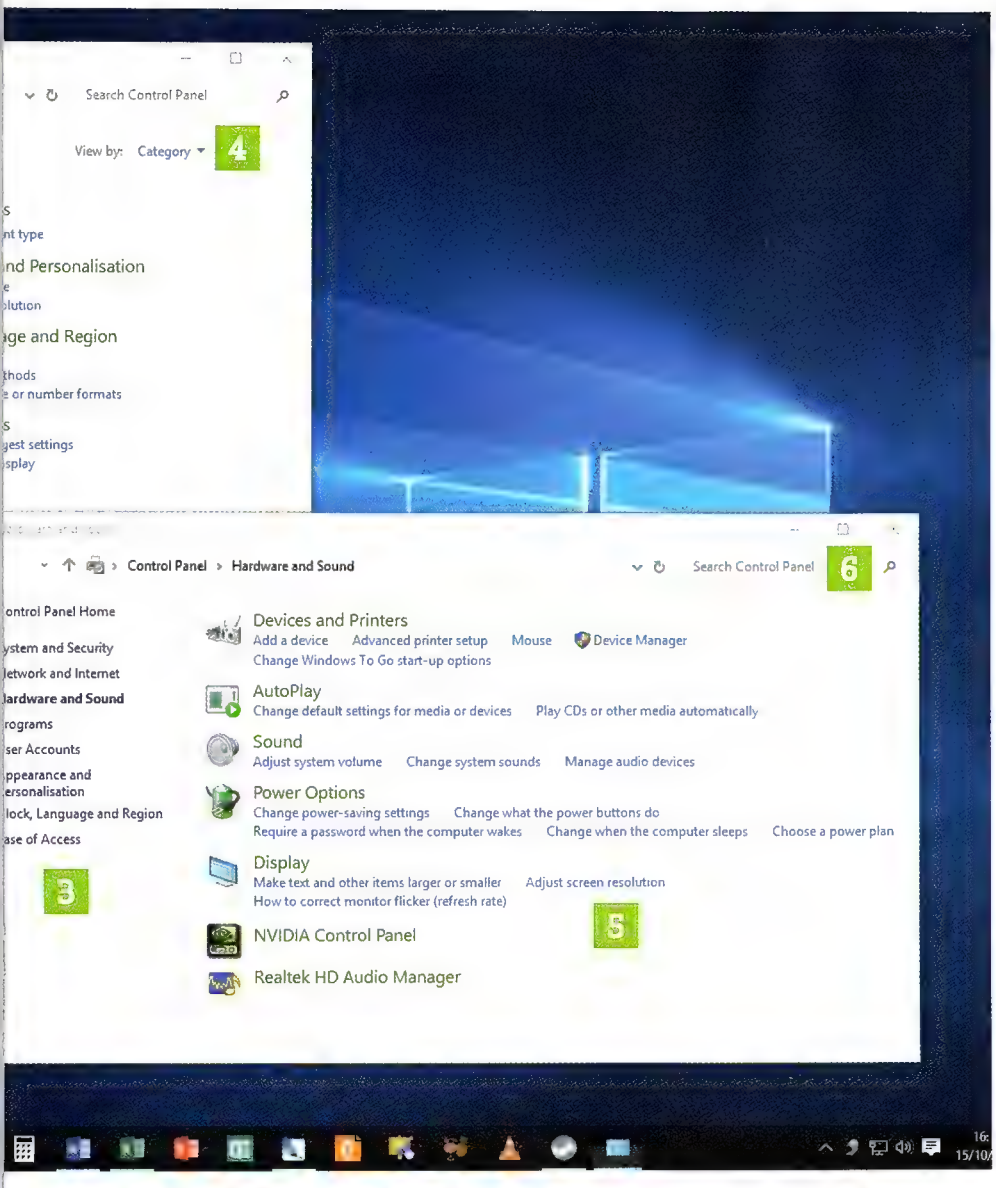
1 OPEN CONTROL PANEL

The quickest way to open the Control Panel is to right-click the Start button and select Control Panel from the Quick Access menu, or make it even more accessible by typing 'control' into the Search box, then right-clicking Control Panel and choosing Pin to Start or Pin to Taskbar. Use the annotation above to help navigate it and find the setting you're looking for.



2 GET SYSTEM INFO

The System Control Panel reveals key information about your version of Windows and its system type (32-bit or 64-bit). It can be accessed by right-clicking the Start button and choosing System or by clicking Start, right-clicking File Explorer and choosing Properties. You can also review your current network name and workgroup — click Change Settings to edit these.



1 QUICK ACCESS
The quickest way to access Control Panel in Windows 10 is to right-click the Start menu and select it from the Quick Access menu.

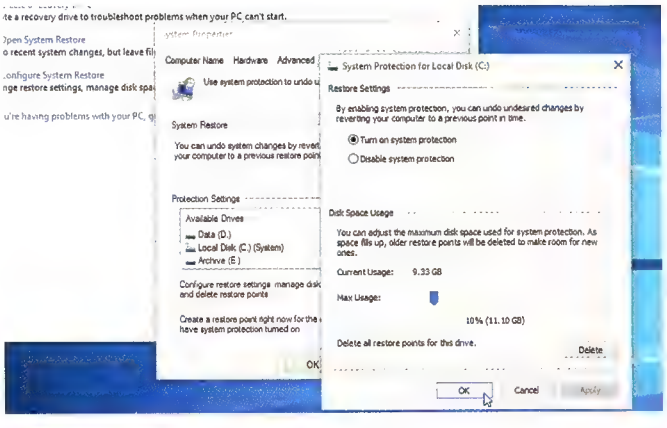
2 CHOOSE CATEGORY
The various Control Panel applets are split into eight broad categories — click a heading to view all available settings.

3 SWITCH CATEGORY
Once you've selected a category, all other categories are displayed in this left-hand pane — click one to switch.

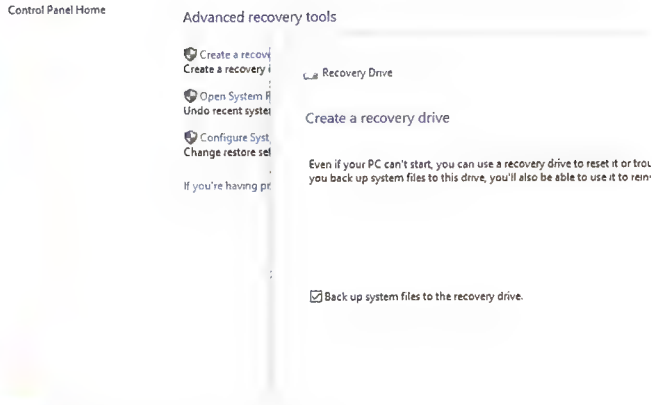
4 CHANGE VIEW
Click here to display all available applets as large or small icons, or to revert to the default Category view.

5 AVAILABLE APPLETS
Each applet has a number of configurable settings —click one of them to jump to a specific option.

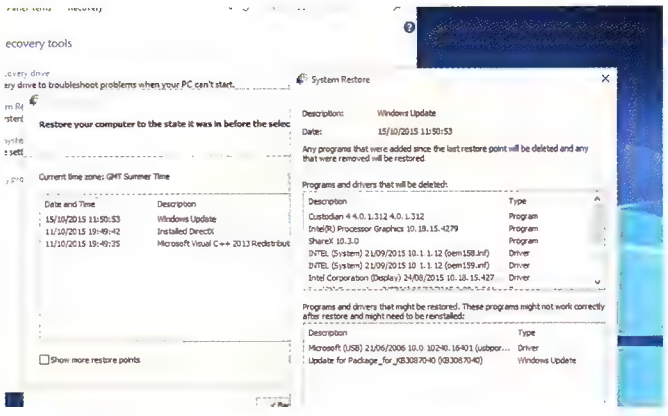
6 SEARCH TOOL
Can't find what you're looking for? Use this search box to track it down using a keyword or two.



3 ACCESS SYSTEM RESTORE
System Restore is switched off by default in Windows 10 — access its settings by clicking System Protection on the System Control Panel or by typing `recovery` into the Search box and clicking the Recovery entry, followed by Configure System Restore. Select your system drive, then click Configure. Switch it on and allocate 5–10% of drive space before clicking OK.

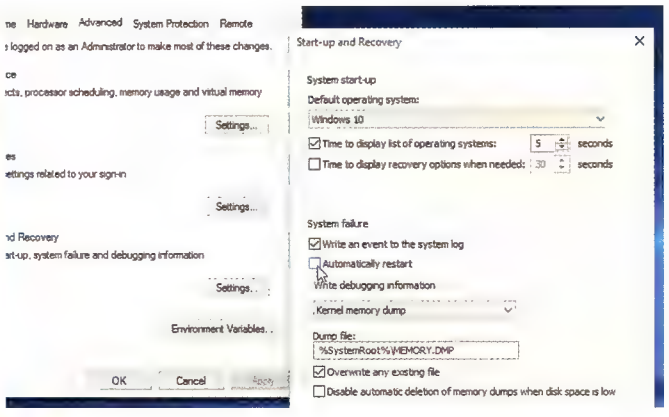

Control Panel Home
Advanced recovery tools
Recovery Drive
Create a recovery drive
Back up system files to the recovery drive.

4 CREATE RECOVERY DRIVE
The Recovery applet also allows you to create a recovery drive to help troubleshoot problems when Windows won't boot — leaving 'Back up system files to the recovery drive' ticked means you'll need a larger USB drive, but will be able to reinstall Windows from the drive. However, it won't always work. Leave it unticked to create a basic drive with troubleshooting tools only.


ecovery tools
System Restore
Restore your computer to the state it was in before the selec
Description: Windows Update
Date: 15/10/2015 11:50:53
Any programs that were added since the last restore point will be deleted and any that were removed will be restored.
Programs and drivers that will be deleted:
Programs and drivers that might be restored. These programs might not work correctly after restore and might need to be reinstalled:
Show more restore points

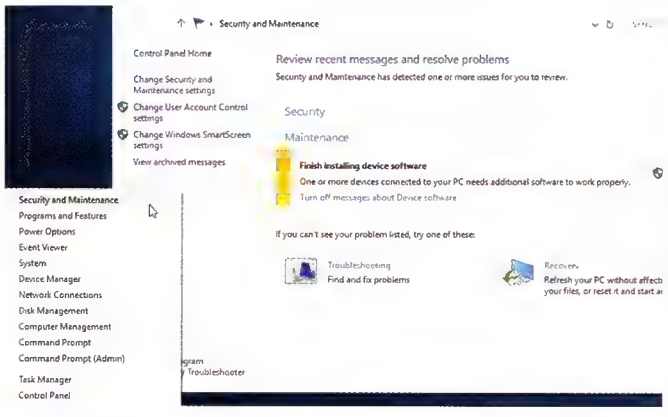
5 RESTORE PC

System Restore can be opened via the Recovery applet too, which you can use to roll your misbehaving PC back to an earlier point in time. Pick a point, click 'Scan for affected programs' to see what'll be affected, then restore your PC. If it fails, try an earlier Restore point. Click the 'Show more Restore Points' to reveal all supported points or undo the change to try a different tack.



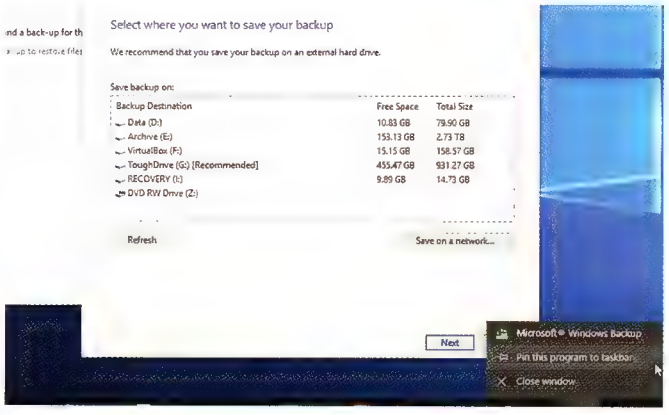
6 ADVANCED SYSTEM SETTINGS

Access additional system tweaks via the 'Advanced system settings' button under System, or by typing 'advanced' into the Search box. Click Settings... under Performance if your PC is struggling with graphics effects, plus tweak virtual memory settings. Click Settings... under 'Start-up and Recovery' to stop Windows automatically restarting after a blue screen of death.


Security and Maintenance
Control Panel Home
Change Security and Maintenance settings
Change User Account Control settings
Change Windows SmartScreen settings
View archived messages
Review recent messages and resolve problems
Security and Maintenance has detected one or more issues for you to review.
Security
Maintenance
Finish installing device software
One or more devices connected to your PC needs additional software to work properly.
Turn off messages about Device software
If you can't see your problem listed, try one of these:
Troubleshooting
Find and fix problems
Recovery
Refresh your PC without affecting your files, or reset it and start over
Security and Maintenance
Programs and Features
Power Options
Event Viewer
System
Device Manager
Network Connections
Disk Management
Computer Management
Command Prompt
Command Prompt (Admin)
Task Manager
Control Panel

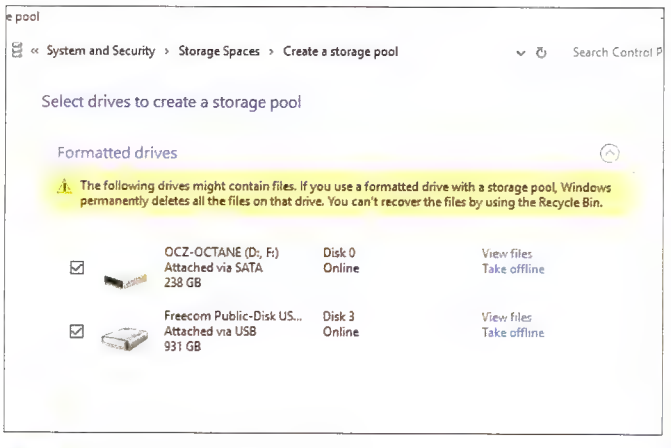
7 WHERE'S THE ACTION CENTRE?

The Notification Center appears, on the surface, to have superseded the old Action Centre, but in actual fact, it's simply been renamed 'Security and Maintenance', and the quickest way to get to it is via the Quick Access menu (right-click the Start button). You'll find it's still the go-to place for security and maintenance messages, as well as accessing troubleshooters.



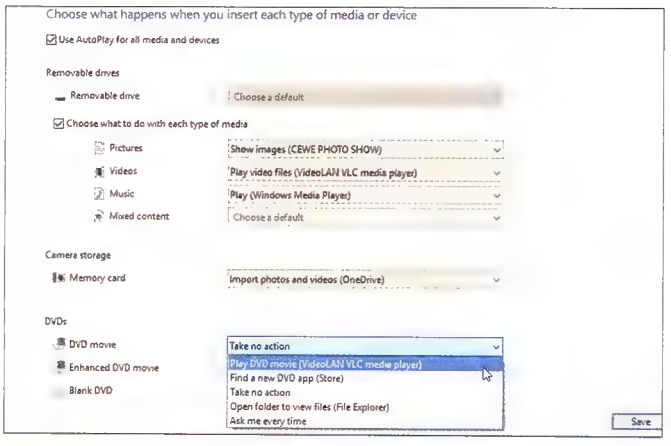
8 GET BACKED UP

While Windows 10 supports Windows 7's Backup feature, it favours File History via the Search box and Settings. If you prefer the older backup tool, type 'Windows 7' into the Search box to access it. Once you've clicked 'Set up back-up' to start it, right-click the Taskbar shortcut and choose 'Pin this program to Taskbar' to give you easy one-click access to the tool in the future.


System and Security › Storage Spaces › Create a storage pool
Search Control P
Select drives to create a storage pool
Formatted drives
The following drives might contain files. If you use a formatted drive with a storage pool, Windows permanently deletes all the files on that drive. You can't recover the files by using the Recycle Bin.
OCZ-OCTANE (D:, F:)
Attached via SATA
238 GB
Disk 0
Online
View files
Take offline
Freecom Public-Disk US...
Attached via USB
931 GB
Disk 3
Online
View files
Take offline

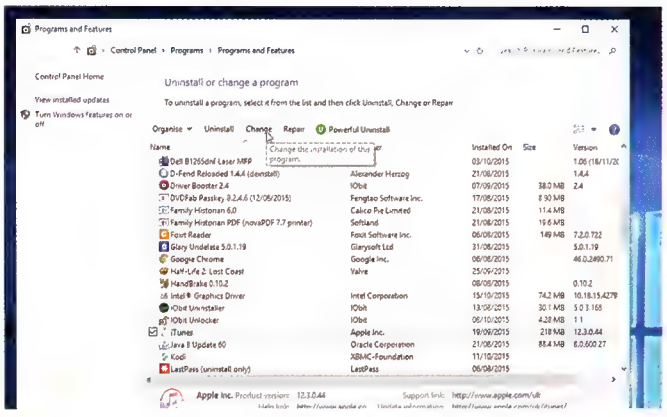
9 BRING DRIVES TOGETHER

Storage Spaces lets you combine two or more smaller drives into one large virtual drive (or provide protection against data loss without having to set up a RAID array). Type 'storage' into the Search box and click Storage Spaces. Click 'Create a new pool and storage space', select the drives you want to join (read the warning about deleting data), and let Windows do the rest.



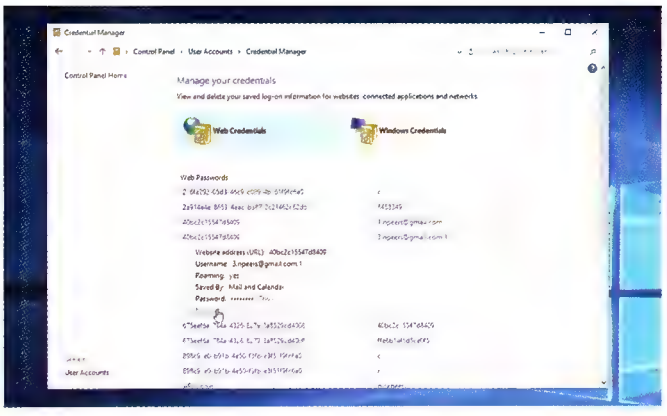
10 DEFAULT APPS

Type 'default' into the Search box and click the Default Programs shortcut to manage your apps and autoplay settings. Click Set Default Programs to select an app, review what defaults it has and, if necessary, assign it all available defaults to ensure it works correctly. Choose Change AutoPlay Settings to decide what happens when you insert CDs or other media.



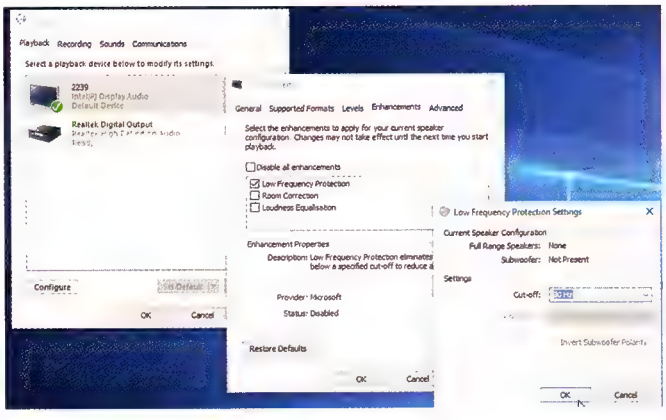
11 PROGRAMS AND FEATURES

Need to repair or make changes to a program rather than simply uninstall it? The Settings app doesn't cut it. Instead, right-click the Start button and choose Programs and Features to access the more powerful Control Panel. You can also manage (and remove) Windows Updates from here, plus switch on (and off) Windows features such as the XPS viewer and services.



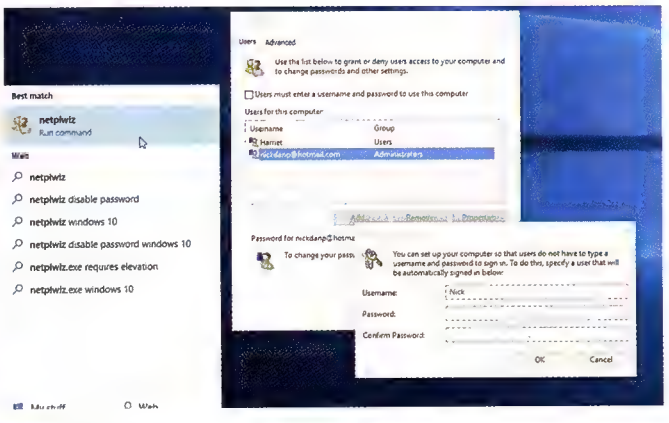
12 MANAGE CREDENTIALS

Wonder where Windows stores all those passwords it saves automatically? Type `cred` into the Search box and click Credential Manager to find out. Expand Web Credentials to see which passwords have been saved by Edge, Internet Explorer and other apps (as well as Windows) — expand one to view or remove it, your user account password may be requested.



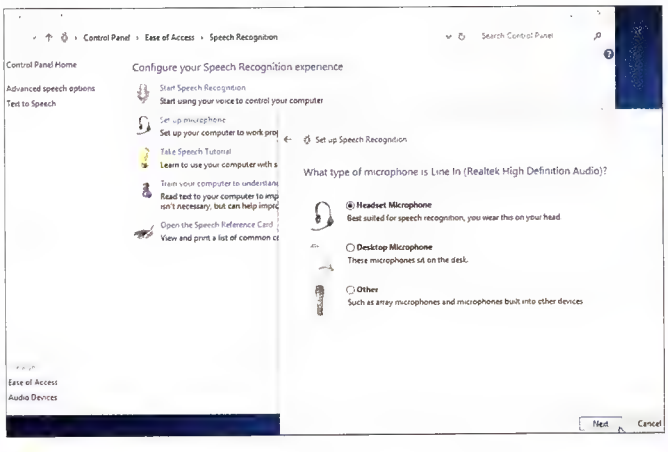
13 EDIT AUDIO SETTINGS

There's no dedicated Sound section in Settings, but the old Control Panel is easily accessible from the Taskbar Notification area. Right-click the volume icon and choose Playback to manage default playback (and recording) devices. Select an entry to make it the default, configure speaker settings and tweak advanced properties, such as adjusting sound level and quality.



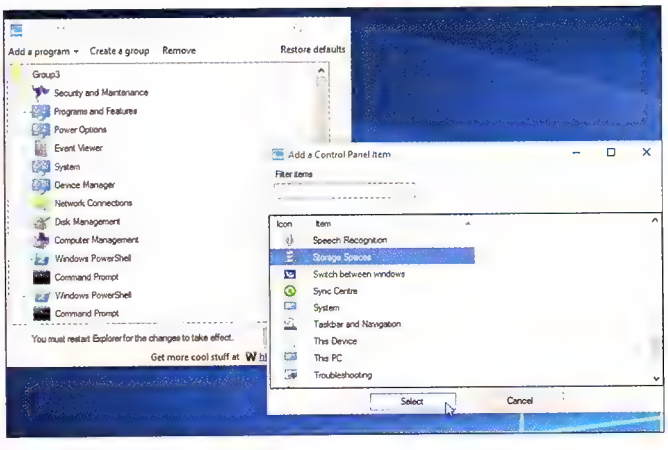
14 BYPASS LOGIN SCREEN

Type `netplwiz` into the Search box and click the entry that appears to access a hidden User Accounts Control Panel. If you're the only user of your PC, you can configure Windows to bypass the lock and login screen by selecting your username, then unticking 'Users must enter a username and password to use this computer'. Click Apply, enter password (carefully!) and click OK.


Control Panel
Ease of Access
Speech Recognition
Control Panel Home
Configure your Speech Recognition experience
Start Speech Recognition
Start using your voice to control your computer
Set up Speech Recognition
What type of microphone is Line In (Realtek High Definition Audio)?
Headset Microphone
Best suited for speech recognition, you wear this on your head
Desktop Microphone
These microphones sit on the desk.
Other
Next
Cancel

15 SET UP SPEECH

Type 'speech' into the Search box and click Speech Recognition under Settings. You'll need to provide a headset or mic, then click Start Speech Recognition, which will step you through setting up your computer and training Windows to recognise spoken commands. Other options include a training program to help Windows learn how you speak.



16 ADD PERMANENT SHORTCUTS

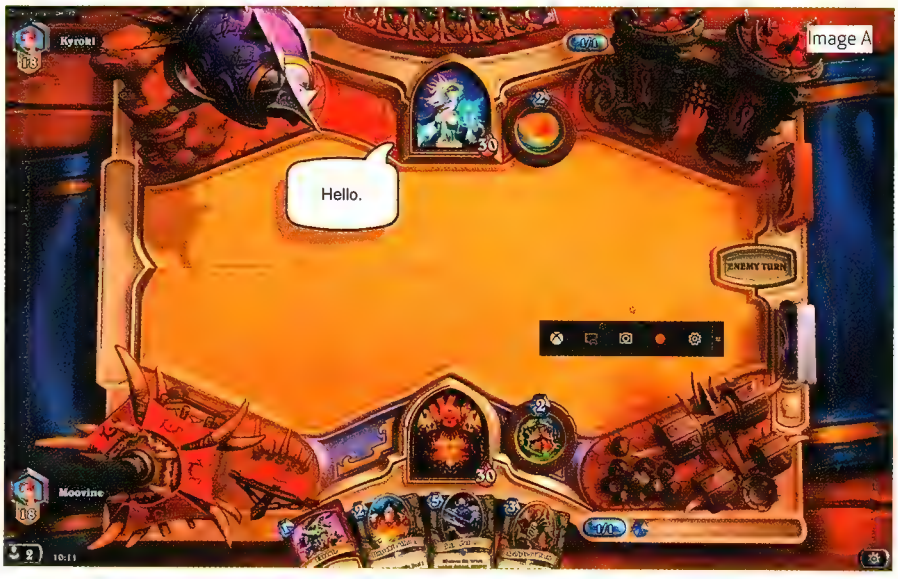
Finally, add your favourite Control Panel items to the Quick Access menu for quick access. Download Win+X Menu Editor (**winaero.com/download.php?view.21**), extract the program files and run the x64 (64-bit) or x86 (32-bit) version depending on your Windows system. Choose 'Add a program > Add a Control Panel item' to add any Control Panel applet to the menu.

Record your screen on Windows 10

How to trick this Microsoft gaming app into recording just about anything.

Being able to record your screen can be helpful if you want to demonstrate to someone how a tricky thing is done in Photoshop, or show off your ungodly gaming skills on YouTube. Either way, up until now, it's involved installing a third-party tool and then fiddling with it until it works. With the advent of Windows 10, however, Microsoft has bundled in a screen-recording app as part of its Xbox integration features. It's clearly meant for use when gaming, but oddly enough, it works with any desktop app – all you have to do is tell Windows that it's a game.

There's a simple keyboard shortcut to bring up the Xbox app and start recording. Microsoft hasn't officially announced this feature, so there's a chance it could be modified or patched away with a future update, but it works fine for now.

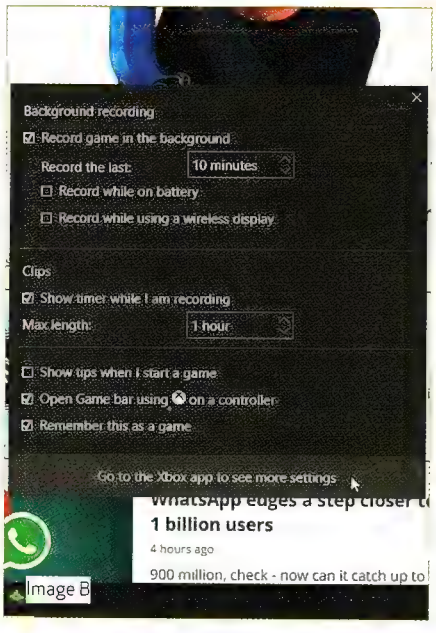


1 PREPARATION

Unless you happen to get lucky and catch your boss slipping on a pile of manure and into a burning patch of poison oak, the best videos tend to be planned in advance. Write out a running order for your video on a piece of paper, keep it out of shot, and rehearse a few times. If you're capturing game footage, think about what you want your capture to show. Equip the items you need, pause the game, then unpause it after you begin recording – you can trim the footage later.

2 THE GAME BAR

It's not somewhere you'd go for an anonymous liaison with a woodcock, but a built-in Windows screen overlay that's meant to record Xbox One apps being streamed to your PC. Open it with Windows key–G. It's worth doing this at least once before recording as it comes up more slowly the first time.


Background recording
Record game in the background
Record the last:
10 minutes
Record while on battery
Record while using a wireless display
Clips
Show timer while I am recording
Max length:
1 hour
Show tips when I start a game
Open Game bar using on a controller
Remember this as a game
Go to the Xbox app to see more settings
1 billion users
4 hours ago
900 million, check - now can it catch up to
Image B

3 GET TO KNOW THE CONTROLS

The Game Bar is fairly straightforward, with a red recording button that's just begging to be pressed [Image A]. There are four other buttons, though. The Xbox logo opens the Xbox app; Record That turns on background recording; then there's the camera button, which takes a screenshot; and the Record button itself. The cogwheel opens up the settings [Image B].

4 SETTINGS

The app only captures the currently active window, so it's worth having it maximised or in a borderless window mode if you want it to fill a

Windows Movie Maker

Windows 10 doesn't have a built-in video editing app, and the Store is rather lightly populated by them.

However, you don't have to shell out on a brand new copy of Adobe Premiere Elements (unless you really want to; it's a fine application) as the Windows 8 version of Movie Maker is still available for free and works with Windows 10. Head to **http://bit.ly/1oiRnLg** and click the top option to begin the download.

Install it as usual, though you probably won't want the other applications bundled with it, such as the defunct Microsoft Messenger. Alternatively, if you upload your raw clips to YouTube but not publish them, you can still use the site's editor (**http://bit.ly/ZLeWqp**) to knock your videos into shape, creating a new movie that you can then happily publish.

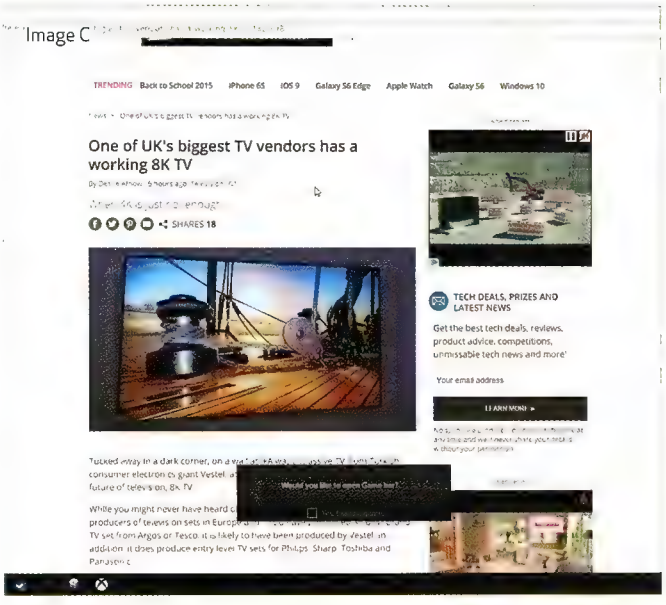
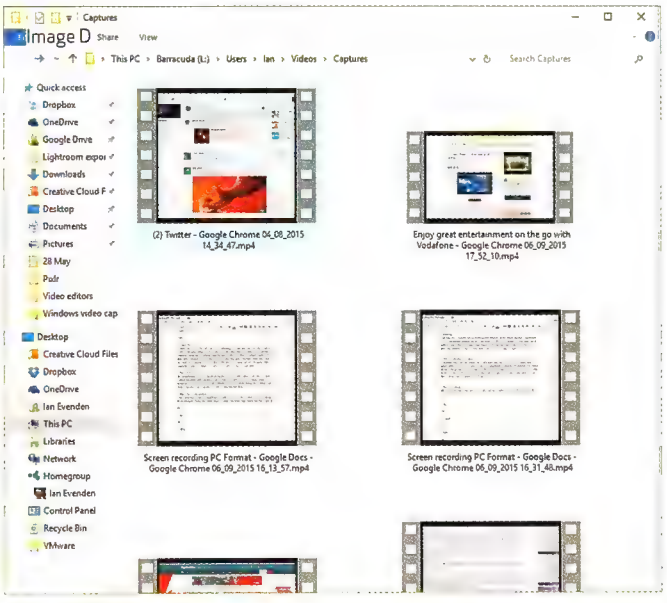


Image C
TRENDING Back to School 2015 iPhone 6S iOS 9 Galaxy S6 Edge Apple Watch Galaxy S6 Windows 10
One of UK's biggest TV vendors has a working 8K TV
SHARES 18
TECH DEALS, PRIZES AND LATEST NEWS
Get the best tech deals, reviews, product advice, competitions, unmissable tech news and more!
Your email address
LEARN MORE



16:9 screen on playback. Most settings are in the Xbox app, under Game DVR, but the Game Bar has a few, too, including whether it should remember that the current app is a game.

5 YES, MY BROWSER IS A GAME

It sounds crazy, but the Game Bar really does ask if your current application is a game when it launches [Image C]. It also trusts you completely. Chrome, Photoshop and Word all become games if you tick the box. From the settings icon on the bar, you'll be able to tell it to remember that your selected app is a game, so it won't ask again. Once this is done, the bar opens as normal.

6 START RECORDING

Hit the red record button and the screen capture begins. A red marker appears in the top corner of your window with a counter to see how long you've been going. Click the arrow on this and it'll disappear, but it doesn't appear on the final video so can be safely left there. When you want to stop recording, press Windows key–G again and the bar will reappear, with a Stop button next to its counter.

7 GET NOTIFIED

When you stop, you'll get a notification in the bottom-right of the screen that your video has been saved. Click this and you'll be taken to the Xbox app, where a list of all your videos can be found. There are a few options on this screen. You can rename your file, trim it and play it back, but unless you captured from a game, the Share button won't work, as it's sharing to Xbox Live rather than Twitter, and Live is a games-only zone. To share the old-fashioned way, use the Open Folder button to get at the file [Image D].

8 MORE SETTINGS

There are a few quality settings in the Xbox app, which affect not just the quality of the saved video, but also the strain its capture puts on your PC. If you're having trouble maintaining a playable frame rate while capturing (this is less of a problem when capturing from non-game apps), then turning down the quality can help you out. We tested the quality levels, and didn't notice a huge difference when uploaded to YouTube.

9 BACKGROUND CAPTURE

A little like Nvidia's Shadowplay, this makes a user-defined amount of game time – from 15 seconds to 10 minutes – available for capture. Take a tour of Mother Base or pull off an outrageous takedown, and you can save it with a keystroke to share later – hit Win–Alt–G, but you need to have enabled it first in Xbox app settings and switched it on with the Game Bar.

10 FILE HANDLING

The files produced by Game DVR are in MP4 format, but their resolution depends on the size of the window you had open when you started capturing. If it was 1,036 pixels high, your video will be too, and some editing apps might have a problem with this.

We tried it in Windows Movie Maker (see opposite), however, and it was fine, adding black bars either side.

If you want to make sure you're capturing a full 1080p frame (or higher if you're fancy), you might want to use background capture in full screen mode. Check its settings to make sure it doesn't stop recording before you've finished.

Alternative simple recording options

1 SHADOWPLAY

www.geforce.com

Nvidia's recording option saves the last 20 minutes of your gameplay, and needs to be turned on in the GeForce Experience app. It claims about a 5% performance hit, and works up to 4K resolutions. AMD users can use the AMD Gaming Evolved app in a similar way.

2 EZVID

www.ezvid.com

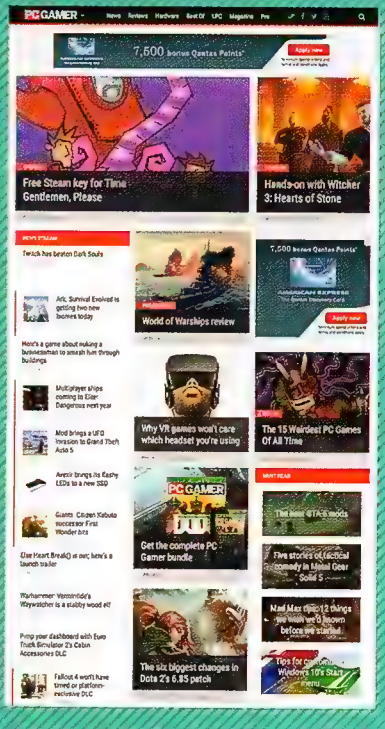
A free screen recorder and basic editor, EZvid can record games as long as they're running in windowed mode — it captures the entire screen, so any app can be recorded. You can also use it to make a slideshow from stills, useful for tutorial videos.

3 CAMSTUDIO

camstudio.org

A recording app that's full of options. Hide or reveal the mouse pointer, record program sounds, record voiceover from a mic and so on. It'll save your captures as an AVI file, and convert them to a Flash video if you really want it to.

SMARTER COOKIES ENABLED


PCGAMER
7,600 bonus Qantas Points*
Apply now
Free Steam key for Time Gentlemen, Please
Hands-on with Witcher 3: Hearts of Stone
Twitch has beaten Dark Souls
Ark: Survival Evolved is getting two new biomes today
Here's a game about making a behemoth to smash him through buildings
World of Warships review
7,500 bonus Qantas Points*
AMERICAN EXPRESS
Apply now
Multiplayer ships coming to Elite: Dangerous next year
Mod brings a UFO invasion to Grand Theft Auto 5
Awesir brings its flashy LEDs to a new SSD
Giants: Citizen Kabuto successor First Wonder bra
Use Heart Break() at own, here's a launch trailer
Warhammer: Vermintide's Waywatcher is a stabby wood elf
Prep your dashboard with Euro Truck Simulator 2's Cabin Accessories DLC
Fallout 4 won't have timed or platform-exclusive DLC
Why VR games won't care which headset you're using
The 15 Weirdest PC Games Of All Time
PCGAMER
Get the complete PC Gamer bundle
MUST READ
The best of TF2's mods
Five stories of tactical espionage in Metal Gear Solid 5
Mad Max: the 12 things we would've known before we started
The six biggest changes in Dota 2's 6.85 patch
Tips for Customizing Windows 10's Start menu

JOIN US ONLINE AT
WWW.PCGAMER.COM

exclusive software

» HOW TO DOWNLOAD YOUR FREE FULL-VERSION PROGRAMS

ISSUE 423, CHRISTMAS 2015

Where's the disc?

APC's full-version software will now be provided exclusively online.

Please note that due to supplier circumstances beyond *APC*'s control, this month's disc could not be provided in time to make the printer's deadline. As a magazine however, we've been contemplating the removal of *APC*'s disc for close to a year now, and after assessing the situation internally and speaking with readers (some of whose letters were published in earlier editions) we began a 'no disc' pilot program in New Zealand several months ago. While there were obviously some readers who were disappointed, most understood that times change and that with broadband now nearly ubiquitous, most of the exclusive software on offer could just as easily be provided online – something which we've been doing for around 6 months already.

Given the circumstances, we've therefore made the decision that, as of this issue, *APC*'s physical disc will be discontinued. However, that doesn't mean we're discontinuing the exclusive full-versions. you can still find these by following the instructions we've included below. **Please note that these exclusive downloads will only be available for a limited time, from10/12/2015 to 27/01/2016.**

CHERISH AND ORGANISE YOUR PHOTOS

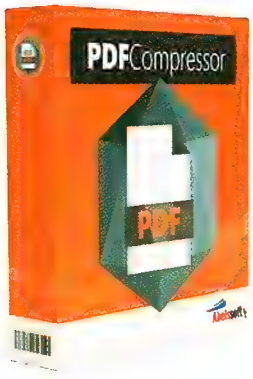
Never lose a memory with Ashampoo Photo Commander 12

FULL VERSION WORTH $39.99

Ashampoo Photo Commander 12 is the ultimate in photo management. Effortlessly browse through large photo collections and remove annoying image defects on the fly. Optimise colour and contrast settings and make your photos shine. Get creative and bring your photos to life with professional image effects and surprise your friends with self-made calendars, collages and greeting cards.

Full version requires online activation.

DOWNLOAD LINK: WWW.ASHAMPOO.COM/LPA/APC



SEND YOUR PDFs WITH EASE

Make PDF file sizes managable with Abelssoft PDF Compressor.

FULL VERSION WORTH $39.99

Abelssoft PDF Compressor is the ideal everyday helper, when it comes to sending small PDFs. In comparison to other programs, PDF Compressor accomplishes compressing large PDFs with many pages in record time. If you work with many PDFs, there is a convenient batch processing feature. Simply paste all the PDFs to compress into the tool in one go, and then let PDF Compressor work for you. The processed PDFs will automatically be saved in the target folder.

DOWNLOAD LINK: WWW.APCMAG.COM/EXCLUSIVES

DOWNLOAD ZIP PASSWORD: CHRISTMAS15C

Toolkit: 5 Awesome Productivity Tools

Get them all at **www.apcmag.com/exclusives**

COLD TURKEY
Cold Turkey is a neat app that lets you block access to programs, games and even specific websites on a timed basis, so you won't squander all that time when you should be working.

INKSCAPE
Inkscape isn't the easiest application to master, but if you want to create vector graphics there's no better free solution.

TRILLIAN
With Trillian, you don't need to standardise. Log in with your Google, AOL and Facebook accounts, and all of your instant messages will end up in one place.

TEAMVIEWER
If you need to gain control or spectate on multiple computers, TeamViewer is absolutely perfect.

FILEZILLA
FTP is an internet protocol focused specifically on file transfers. It's by far the best FTP client out there, and makes uploading and downloading large files quick and easy.

DISCLAIMER Future Publishing is not the licensor of the exclusive software or any documentation included with it. Rather, Future is merely a distributor of the software, and your use of the software is subject to any accompanying third party licence terms. You must carefully read and comply with any such third party licence terms, together with all instructions and README files that come with the software. Accordingly, to the maximum extent permitted by law, all software is provided by Future 'as is' and without warranty either express or implied, and Future will not be liable for any damage that you may incur as a result of using any software downloads. You should back up any important system and data files before using any downloaded software. We recommend that you do not use the exclusive software on a production machine. Nothing in this disclaimer excludes any warranty that may be implied by statute, which may include the Trade Practices Act. While we have taken all reasonable steps to check the software downloads for viruses, we cannot guarantee that it is free from viruses or other harmful code and you should check each disc using a virus scanner complete with the latest antivirus updates before use.

Keep up to date with Apple News

Get all of your news about the world and personal interests in one place.

Apple's News app provides you with a single place to catch up on happenings related to all your interests, whether that's current affairs, technology updates, the world of entertainment or something else. If you've ever subscribed to a favourite website's updates using RSS, you'll be familiar with the concept – the difference here is that you don't need to visit a site using the Safari web browser. Instead, news organisations and other types of publishers sign up to be listed in Apple's catalogue of content providers, which you can browse in the News app and tap a button to add them to your customised digital newspaper or magazine.

Of course, you'll want to be able to share interesting things you read with other people. Naturally, the sharing options built into iOS – to mark things as favourites or to send links by private message such as email or to social networks like Facebook and Twitter – are available in the News app.

Finding your way round the News app.

A NEWS STORIES
News items from your subscribed sources appear here, listed with a short excerpt, a logo that shows the source, an indication of how long ago the item was published, and sometimes a thumbnail image, too. You can simply tap an item to open it, or apply light pressure on an entry to take a closer peek at its contents, then press harder if you want to read the whole item. Alternatively, you can swipe upwards from the preview to mark the item as something you like, to save it to your reading list, or to share the item with other people by private message or on a social network. These same actions are available from icons in the bottom toolbar once you've popped open a story.

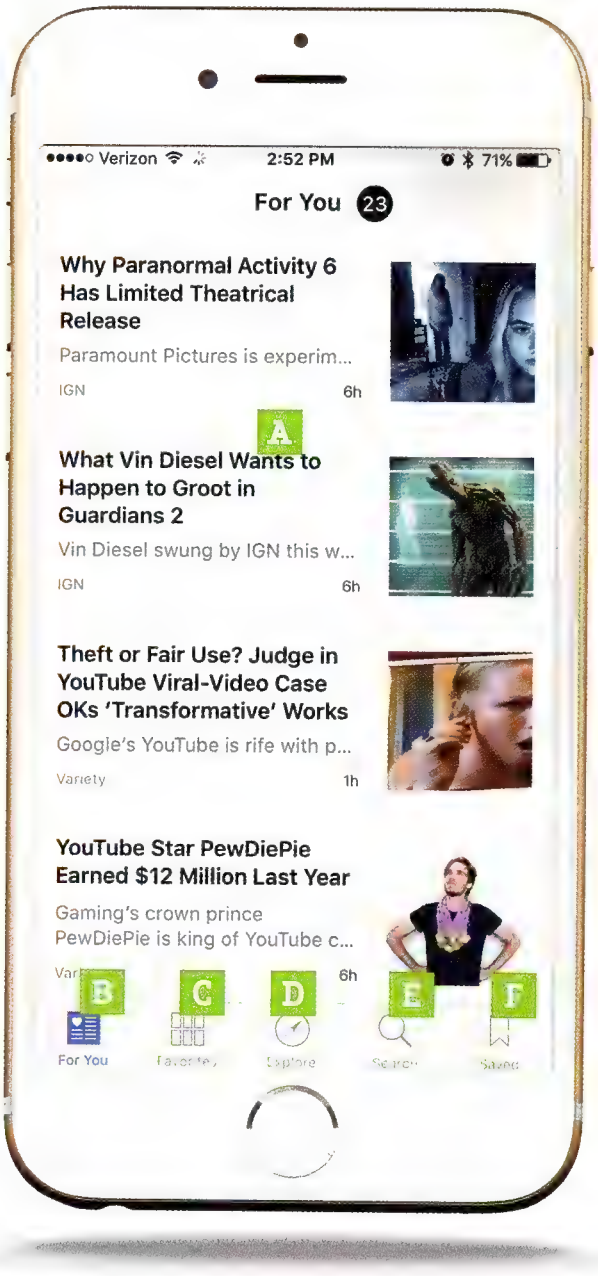
B FOR YOU
Selected stories from your favourite sources are displayed on the For You screen in list form, sometimes with a preview image. The app will mix in categories that might be of interest, so that you don't only discover them manually (see step 4).

C FAVOURITES
Any sources you subscribe to during the initial setup process, or later under Explore (again see step 4), are listed here. Tap one to browse its full range of updates.

D EXPLORE
After the initial set-up, tap here to find more news sources. The advantage of this page is that you can browse by topic, including technology, sport and health, so you can quickly add specific interests to your growing list of favourites.

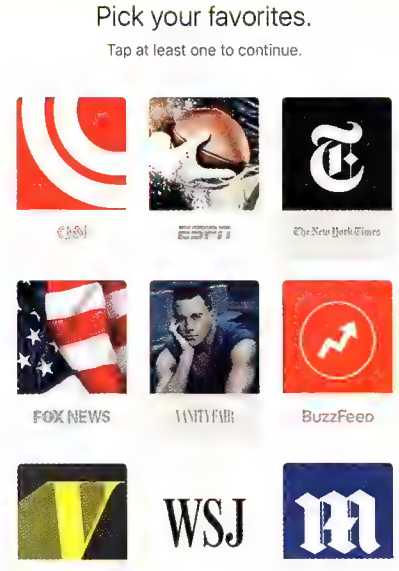
E SEARCH
Just like searching the iTunes Store for music and films, you can enter search terms, from very broad ones, such as "TV," to very specific interests, such as "Star Wars".

F SAVED STORIES
You can bookmark individual stories so they're easy to find. Saved stories are shown in a list like the For You page, and you can share them in a private message or on social media.



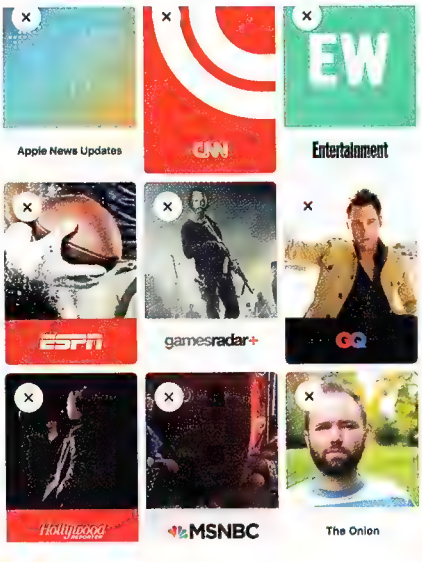
How to:

Set up your News subscriptions



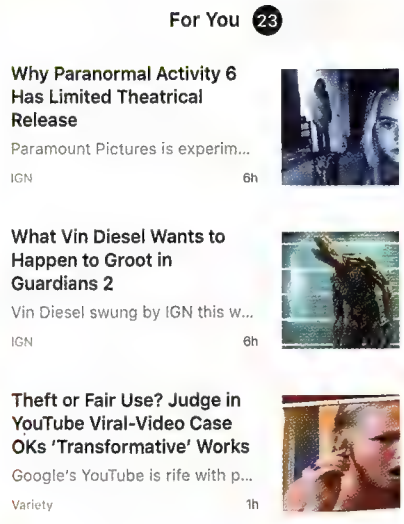
1 GET STARTED

When you open the News app, you get a link to the service's privacy policy. Tap Get Started, then browse the suggested channels, tapping any you want to subscribe to (highlighted with a blue border). More channels appear as you scroll; once you've added major news providers, you're better off tapping Continue (bottom of the screen) and finding specialist interests another way…



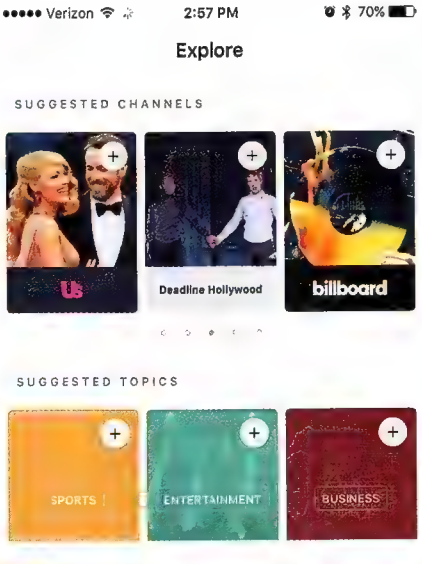
4 FAVOURITE CHANNELS

Channels you added during step 1 are listed here, and you can add more from the Explore page (see step 5). To remove a channel, tap Edit (top right) and the X in the top left corner. Tap Done to return to reading. Tap a channel listed here to browse that publisher's stories. Browsing some channels directly, such as CNN, ESPN, Us Weekly and Reuters, provides a means to browse their broad content by category.


For You 23
Why Paranormal Activity 6 Has Limited Theatrical Release
Paramount Pictures is experim...
IGN 6h
What Vin Diesel Wants to Happen to Groot in Guardians 2
Vin Diesel swung by IGN this w...
IGN 6h
Theft or Fair Use? Judge in YouTube Viral-Video Case OKs 'Transformative' Works
Google's YouTube is rife with p...
Variety 1h

2 SELECTED FOR YOU

When you tap Continue, News will prepare a list of interesting stories from the channels you selected. You'll be taken to the For You page, where these stories appear in a list. Tap one to open it. Either lightly press on it to take a peek, or if it has a larger picture and extra lines of text, press harder to reveal the story in full. When you return to the list, items that you've read are grayed.



5 FIND MORE CHANNELS

At the top of the Explore page, the app suggests channels and topics you might also be interested in. Tap the + (top right) of one of them to subscribe to it, or tap on its graphic to investigate; tap the + at the top right of the screen to subscribe to it. Further down the Explore page, you can browse for channels by category; the same shortcuts already described work there, too. If you still can't find what you want, tap Search and enter keywords.

Nicolas Hoult's Actioner 'Collide' Bought by Open Road for U.S.
Variety
OPEN ROAD FILMS
Open Road Films has acquired U.S. rights to Nicolas Hoult's action thriller "Collide" for U.S. distribution from IM Global and plans an April 1 release. The film, directed by Eran Creevy, stars Hoult, Felicity Jones, Anthony Hopkins and Ben Kingsley. It was financed by

3 SHARE AND SAVE

Three icons appear at the bottom of a story. The Share icon enables you to share the story on social networks and in private messages, add a link in Notes or Reminders, open the version published on the web in Safari, or report concerns about the content. The heart icon marks a story as something you like. The bookmark adds the story to the Saved page so you can quickly find it again.

AirDrop. Share instantly with people nearby. If they turn on AirDrop from Control Centre on iOS or from Finder on the Mac, you'll see their names here. Just tap to share.
Message
Mail
Reminders
Notes
Add to Reading List
Copy
Open in Safari
Report a Concern

6 READING TIPS

Among the actions listed when you tap the Share icon while reading a story is Report a Concern. This draws Apple's attention to content that's contentious, "broken" or improperly categorised. When you open stories that originate on a channel's website, you'll see only a summary until you swipe upwards to load the whole thing. This can be overridden in the Settings app; go to News and turn off Show Story Previews.

Securely empty the Trash in OS X El Capitan

Matthew JC. Powell shows how to make sure the things you erase are really erased.

Alongside the many features introduced with OS X 10.11, there is one that has disappeared: the "Secure Empty Trash" command formerly located under the Application menu in the Finder (that is, the menu headed "Finder") is no more. But fear not, for it is still possible to erase files securely – it's just harder than it used to be.

To understand why Apple removed the command, it's necessary to understand what happens when the Mac erases files. First, when you move a file to the Trash, it is not deleted – you know that, of course. That has been the way ever since the very earliest days of OS X. Moving a file to the Trash merely alters its visibility in the file system.

Emptying the Trash, likewise, does not actually delete the file. All it does is delete the file's entry in the file system index, letting the computer know that the space formerly occupied by that file is available for other usage. Until something else is written to that space, the file is still there and can be recovered by anyone with the will and means to recover it.

That's where "Secure Empty Trash" came in. When you selected this command, the files were not only deleted from the index, but the space they occupied on the disk was overwritten with other data, making your files much harder to recover – nearly impossible, in fact.

The problem is that all of the above relies on files being stored in set, allocated, non-changing address space on mechanical magnetic hard drives. This is not how files are stored on solid-state drives (SSDs). What's more, different SSDs behave differently to each other, and there are other settings that can be enabled that complicate matters even further.

With the increasing popularity of SSDs and hybrid SSD/mechanical drives (which can dynamically move files around depending on usage), the Secure Empty Trash command could no longer be guaranteed to work as promised. Security that isn't guaranteed is no security at all, so Apple dropped the command.

Spot the difference. The Secure Empty Trash command from Yosemite (left) has been removed from El Capitan (right) because it was, quite simply, not as secure as it looked.

```
The-Walrus:~ mjcp$ diskutil secureErase freespace 0 /Volumes/Thunderbolt\ SSD
Started erase on disk1s2 Thunderbolt SSD
Creating a temporary file
Securely erasing a file
[ / 0%..10%..20%..30%..40%..50%..60%..70%..80%..... ] 82% 0:04:58
```

Lost and found. Apple removed the Erase Free Space command from the graphical version of Disk Utility, but it's still there in the Terminal. You even get a sort of progress bar.

```
The-Walrus:~ mjcp$ srm -irv /Users/mjcp/Desktop/junk
Remove /Users/mjcp/Desktop/junk/.DS_Store? y
removing /Users/mjcp/Desktop/junk/.DS_Store
done
Remove /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.47.29 am.png? y
removing /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.47.29 am.png
done
Remove /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.48.26 am (2).png? y
removing /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.48.26 am (2).png
done
Remove /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.48.26 am.png? y
removing /Users/mjcp/Desktop/junk/Screen Shot 2015-08-07 at 10.48.26 am.png
done
Remove /Users/mjcp/Desktop/junk/Screen Shot 2015-09-03 at 1.37.09 pm.png? y
removing /Users/mjcp/Desktop/junk/Screen Shot 2015-09-03 at 1.37.09 pm.png
done
Remove /Users/mjcp/Desktop/junk/Screen Shot 2015-09-03 at 1.42.51 pm.png? y
removing /Users/mjcp/Desktop/junk/Screen Shot 2015-09-03 at 1.42.51 pm.png
done
Remove /Users/mjcp/Desktop/junk? y
```

Burn, baby. Burn. The srm command makes sure that the files you delete are never, ever coming back. Using flags like -i and -v gives you a better sense of what's going on.

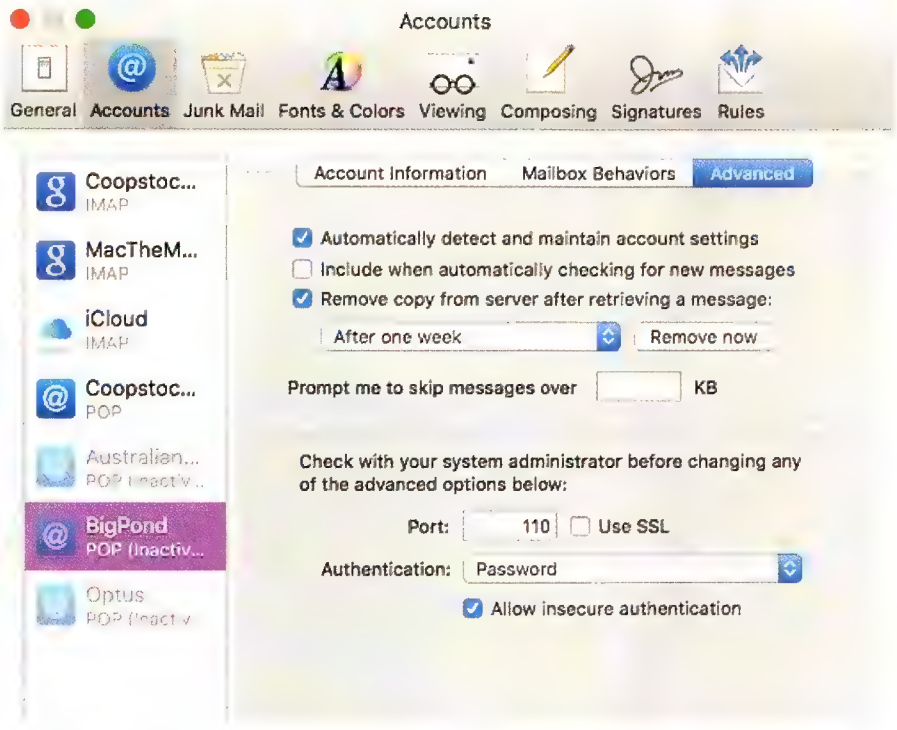
NOW THE GOOD NEWS

If you still use a mechanical drive – as lots of us do because they're so damn big and so damn cheap – you can still securely erase your files to keep them from nefarious evildoers. It just means diving into the Terminal to do it.

Unix uses a command called rm (short for "remove") to delete files. To use it, simply open the Terminal, type `rm` and then drag the file you want to delete into the Terminal window. You will see that the complete path to the file appears in the command line. Hit return, and the file's gone. Sort of. That's not secure. All you've actually done is delete the file's entry in the file system (what's called "unlinking" in Unix parlance).

To delete files securely, use the `srm` (for "secure remove") command. It works exactly the same way as the rm command, except that, before unlinking the file, srm renames it, truncates it and overwrites it – just like the Finder used to do.

The cool thing with working in the Terminal, of course, is that you have control over exactly how securely you



Tip: El Capitan and BigPond

Some BigPond users are reporting problems connecting to their accounts since upgrading to El Capitan. In many cases, the problem is because of a change in the way El Capitan encrypts passwords for authentication — BigPond doesn't like it.

The fix is pretty easy. Go to the Application menu (the one headed Mail) and select Preferences (not Accounts). In Preferences, click on the Accounts tab and then click on Advanced. Tick the box to "Allow insecure authentication" and you should be working again.

Yes, this does make your interaction with BigPond a little less secure than it ought to be under El Capitan, but it's no more or less secure than it was under Yosemite.

```
The-Walrus:~ mjcp$
The-Walrus:~ mjcp$
The-Walrus:~ mjcp$
The-Walrus:~ mjcp$ rm /Users/mjcp/Desktop/Screen\ Shot\ 2015-08-07\ at\ 11.10.42\ am.png
The-Walrus:~ mjcp$
```

Unix pathnames can be complicated (this one is for a file on the Desktop), so it's handy to have Unix in a graphical environment where you can drag and drop files to make life easier.

"The cool thing with working in the Terminal is that you have control over how securely you want to delete things."

want to delete things. You set this using "flags" or optional parameters after the arm command.

For example, you could type `srm -simple` to overwrite the file with a single pass of random data. Or if you type `srm -medium`, you'll overwrite the file seven different times — this is the standard accepted by the US Department of Defence for a secure deletion.

Note that both of these are actually meant as time savers — the standard behaviour of the srm command is to perform a 35-pass Gutmann algorithm. If you want to know more about that, look up the Gutmann Method. Needless to say, overwriting a file 35 times makes sure it's gone, but it takes some time.

Other options you can add to srm include:

`-r` Makes the command recursive, so that if you want to delete a folder full of files, it will perform its actions on all of the files within the folder, not just on the folder itself;

`-i` Makes the process interactive, so you're prompted to confirm before deleting each file;

`-v` Stands for "verbose" and makes the Mac tell you each time it has completed an operation — handy if you're deleting a big directory and want to know how far along you've got.

Putting it all together, you could type `srm -riv` then drag the file or files you want to delete onto the Terminal window. All files in folders would be deleted recursively and you would be prompted before each one is deleted (remember, you can't get these back) and you'll get a running commentary on how far along the process is proceeding.

WHAT IF I HAVE AN SSD?

Ah, yes... those. Because of the way SSDs allocate address space for files, the above Unix commands simply cannot be relied upon to work as promised. The only way to delete files securely from an SSD is to work on the whole drive, not individual files.

But again, Apple has made it tricky. In older versions of the Disk Utility, you had the option to "erase free space", which would very handily go through a volume and overwrite any space that the file system said could be overwritten. That option is absent from the El Capitan version of Disk Utility.

But — you guessed it — it's still there in the Terminal.

First, drag the files you want to delete into the Trash and select the Empty Trash command. This will tell the file system they're OK to overwrite.

Then open the Terminal and type:

```
diskutil secureErase freespace X
```

...and drag the SSD you're wanting to secure onto the Terminal window. Its volume and drive name will appear, correctly formatted.

X represents the level of security you want, denoting by a number from 0 to 4. 0 will overwrite free space on the volume with a single pass of zeroes; 1 is a single pass of random data; 2 is a seven-pass erase; 3 is a 35-pass Gutmann algorithm; and 4 is a three-pass erase. Why is 3 more secure than 4? Ask Apple. Also, be warned that performing a 35-pass erase on an entire drive is going to take a very long time. However, if you're that concerned about security, go for it.

Note that this is a sledgehammer approach if you just want to securely delete one file, and doing it too often will shorten the life of your SSD. Plus it won't work with all SSDs. But it's the option Apple has left us for now. ■

Set up a secure FTP for file sharing

Afnan Rehman shows you a better way to share your files, while also keeping the bad guys away.

Today's heavily online world has seen offsite storage, or 'cloud' storage, become a pretty big deal. However, the threats to our cyber security grow every day and many users are heading towards creating their own servers from which they can download and access documents and media. Why, you ask? Why go through all that trouble when I can have free online storage from my ISP (Internet Service Provider) or use one of the numerous free cloud storage services? The answer is simple: security and convenience. By creating your own basic file server or network-attached storage, you gain the most control over your digital content.

For this tutorial, we'll be using CentOS 6.6, a stable Linux version particularly suited for long-term production environments with a long support life cycle. However, these steps can be adapted to just about any Linux distribution (distro) out there, including Fedora, Debian and, with some tweaks, Ubuntu.

The first step is to have your favourite version of Linux distro installed. Have it? Great, now we'll move on to the next steps. Note that, for the remainder of the tutorial, we will use the terminal to execute commands to complete our task. Next, we need to make sure your system is up to date and running the latest packages and drivers, which will help us in connecting the server to clients and keeping it secure. To apply updates, you have to switch to root user. You simply use the `$ su` command to switch users, and type in the root password. (Note: for new users, passwords never show up on the display in command line for security reasons.) Once you become the root user, you will also notice that the '$' sign at the beginning of the terminal prompt will turn into a '#', as shown in the subsequent commands.

The easiest way to go about installing updates is to use the `# yum update` command. This will download and install updates to all currently installed packages on your Linux system. During the installation, it may ask you a few questions regarding the installation. Just type `y` or `yes` for all of these.

SETTING UP A USER

Next, let's create a new user. This is a good idea even if you already have a user that you are logged into, and a necessity if you are using the minimal version of CentOS. This user will install and generally manage the functions of the server applications that we will be using. You can do this by using the `adduser` command, followed by the name of the user and the directory path for the user's files. As an example, the following command creates a user john, with full name as John Doe and **home** directory **/home/john**:

```
# adduser -c "John Doe" -d /home/john -s /bin/bash john
```

Next, we need to create a password for this user. Use the following command to set a password, where

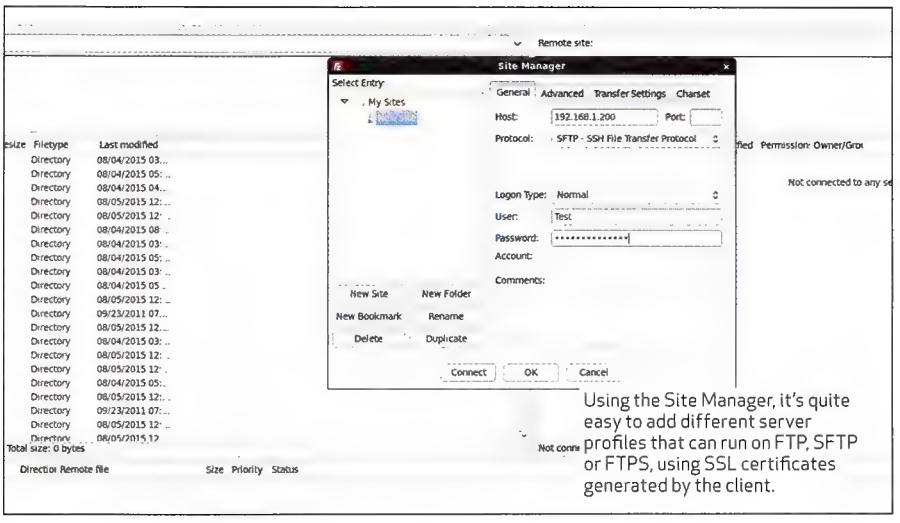
```
Test@localhost:/home/Test
File  Edit  View  Search  Terminal  Help
 GNU nano 2.0.9                File: /etc/ssh/sshd_config

#       $OpenBSD: sshd_config,v 1.80 2008/07/02 02:24:18 djm Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/bin:/usr/bin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options change a
# default value.

Port 2250
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

# Disable legacy (protocol version 1) support in the server for new
# installations. In future the default will change to require explicit
# activation of protocol 1
Protocol 2

# HostKey for protocol version 1
#HostKey /etc/ssh/ssh_host_key
# HostKeys for protocol version 2
#HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_dsa_key

# Lifetime and size of ephemeral version 1 server key
#KeyRegenerationInterval 1h
#ServerKeyBits 1024
```

In the nano editor, you can save the file by hitting Ctrl-X, answering 'yes' at the prompt at the bottom of the terminal window, and hitting the Enter key.

'john' is the name of the user account that you just created. Again, passwords never show up on the display in command line for security reasons.

```
# passwd john
Changing password for user john.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
```

Since this user isn't a superuser/root user, there's less risk of the entire system being compromised in case of a security breach. Now that we have this new user set up, we can proceed to the next step, which will be configuring the services that will allow us to create our SFTP server.



Using the Site Manager, it's quite easy to add different server profiles that can run on FTP, SFTP or FTPS, using SSL certificates generated by the client.

CONFIGURING SSH

We need to configure the SSH (Secure Shell) to access the server securely. What we need to do is edit the SSH configuration file to block remote access to the root user. This is a major security concern and should, in most cases, be disabled. We can access the configuration file using the following command: `# vi /etc/ssh/sshd_config`

A second option for this step is to use the nano editor. Both have their merits, but nano is much friendlier for new users of Linux. If you elect to use nano for your file editing purposes, you must install it using `# yum install nano`. Then open the file using `# nano /etc/ssh/sshd_config`.

Once you're in, search for the `# PermitRootLogin yes`, delete the hash (#) character and change `yes` to `no`. The result should be: `PermitRootLogin no`. While we're here, it can be a good idea to change the port number. Ports are a useful way for different machines to communicate with specific services on the machine. You can think of it like a server being a phone book, and to get in contact with the service you need, you look for a specific number within the phone book. The default TCP (Transmission Control Protocol) port number for SSH is port 22. Hence, it's a very well-known number and there are thousands of scripts running on the internet looking specifically for SSH transmissions on that port. Changing this number can help reduce this risk a little, although there are many ways to scan all the ports of a machine and figure out which port is being used as the SSH port. Ultimately it's up to you if you want to change it. Just remember that, if you do elect to make this change, you will have to specify this port number when logging on from the client device.

To change the port number, go to the line that says Port 22. You can change this number to any unused port. However, one above 1024 is preferable to avoid conflicts with other services running on the server.

Save the file and restart the SSH service using `/etc/init.d/sshd restart` command as root. After you restart the service, the root user will not be able to remotely login over SSH, but will be able to log in locally. Whenever editing a config file, make sure you always restart the service to allow the change to take effect. Not restarting is the reason many Linux tinkerers and developers, especially new ones, often think their edit failed and waste time trying to fix something that isn't broken in the first place.

Once you've followed these steps, you're ready to start sharing files between clients and your server using secure FTP. Next, we will go to our client computer to try to access our newly configured server. We will be using FileZilla, a fast FTP, SFTP and FTPS client that's popular for its stability and ease of use. You can download the latest TAR from **filezilla-project.org** or add it from package manager. Once you've installed FileZilla, let's configure the settings to allow you to connect to your server over the network.

First, open the Site manager by clicking the button on the top left corner. Next, you'll want to add a new server by clicking the New Site button on the bottom left corner of the site manager box, and then configuring the settings on the General tab. Specify the host box with the IPv4 address of your server. You can leave the 'port' text box blank unless you specified a port number other than the default port 22 earlier in the tutorial. Select 'SFTP – SSH File Transfer Protocol' in the Protocol drop down menu.

Once you have done that, specify the Logon Type as Normal from the drop-down menu. In the User and Password text boxes, specify the account details that you created earlier. Once you're done, hit Connect and FileZilla will attempt to establish a connection with your server over the network. And that's it! You have your own network server that you can access over your local network. You'll be able to store media, documents, and other files in a centralised location that's both reliable and secure.

Ubuntu and Debian users

You may be scratching your head here, wondering if I'd forgotten about you guys. However, fear not! There's only one major change that you will need to make, which is simply to switch out the `yum` command with the `apt-get` (the Ubuntu/Debian equivalent) command whenever you come across it in the tutorial. Yum, being a command-line package handler tool that works with Red hat Package Manager (RPM), is different from its Debian/Ubuntu counterpart, the Advanced Packaging Tool (APT). However, both the `yum` and `apt-get` tools are very similar in that they access software repositories (which are basically large sets of software packages) to get their information, which are either situated locally or over the network.

Ubuntu and Debian both support SSH protocol, of course, and the subsequent steps for accessing and changing the config files are very much the same. Fedora users can use the `yum` command just as CentOS users would. FileZilla also works well on any of the major Linux distributions, so feel free to use any distro you want as a client computer.

Be efficient and recycle your macro code

Helen Bradley shows how to reuse your code to simplify your programs.

When you type the same code multiple times, consider reusing your code instead of recreating it over and over. To do this, place the code in a separate procedure and call that procedure whenever you need it. This month, we'll look at doing just that and how to pass values to the procedure as you call it.

CREATE THE SOLUTION

This month's macro creates a dummy document complete with headings and paragraphs. A UserForm gets data from the user and the code behind it creates the document.

Start with an empty Word document and, in the Visual Basic Editor, choose Insert > UserForm. Add three labels, two textboxes, two SpinButtons and two CommandButtons. Arrange the first label, textbox and SpinButton side by side and then the second set. Set both textboxes' Enabled property to False and their Value to 1. Add captions to the labels using the image as a guide. Set the Commandbutton1 caption to "Make Document" and the CommandButton2 caption to "Quit" and its Cancel property to "True".

Set both SpinButton Min properties to 1 and Max to 10. Double click CommandButton1 and type this:

```
Dim numheads, numsentences,
i As Integer
  On Error Resume Next
  numheads = TextBox1.Text
  numsentences = TextBox2.Text
  For i = 1 To numheads
  Call textline(1, True)
  Call textline(numsentences,
False)
  Next i
  Unload Me
```

Double click Quit and type this:

```
  Unload Me
```

Double click SpinButton1 and type this:

```
  TextBox1.Text = SpinButton1.
Value
```

Double click SpinButton2 and type this:

```
  TextBox2.Text = SpinButton2.
Value
```

Type this into the UserForm1 code dialog:

```
  Sub textline(lines As
Variant, headvalue As Boolean)
  Dim mytext As String
  mytext = "The quick brown
fox jumps over the lazy dog. "
  For i = 1 To lines
  Selection.TypeText (mytext)
  If headvalue Then
  Selection.Style =
ActiveDocument.Styles("Heading
1")
  End If
  Next i
  Selection.TypeParagraph
  End Sub
```

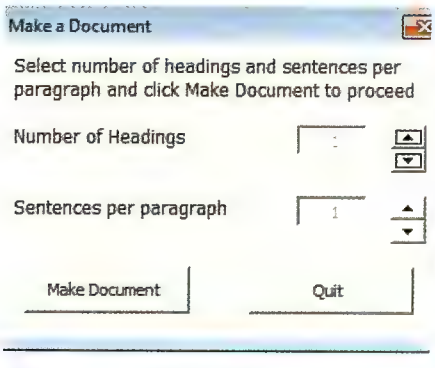
Choose Insert > Module, add this code and save the file as a .docm document.

```
  Sub MakeMyDocument()
  UserForm1.Show
  End Sub
```

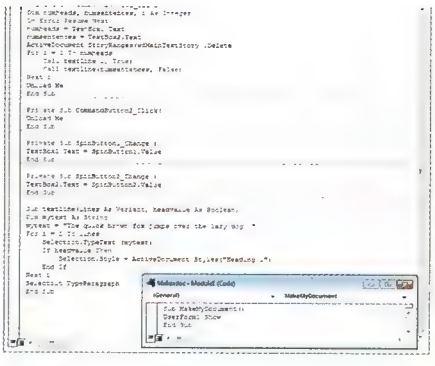
HOW IT WORKS

In the code behind CommandButton1 are calls to the sub procedure textline, which also pass arguments to that procedure. The arguments are a number and a Boolean variable (true/false) and they allow the one procedure to respond differently depending on the values in the variables passed to it. The arguments have to be in the same order in the calling statement and in the procedure declaration but they don't have to have the same name. The variable types have to match or at least be compatible.

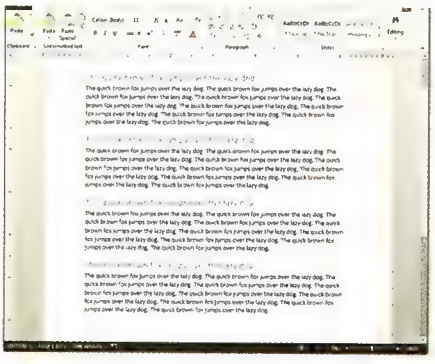
Calling a procedure and passing values to it is a great way to use one piece of code in multiple ways. Once the called procedure has finished execution, control is handed back to the calling procedure, which then continues to execute.



1 STEP 1 The macro is run from a UserForm that gathers the data required for creating the document.



2 STEP 2 This is the code for the UserForm and the Module.



3 STEP 3 When the macro is run, the document is automatically created.

techradar.
The home of technology
techradar.com

Caged power: all on display

If you've spent loads of cash on cool components, why hide them away in an enclosed case?

It's been a good year for new PC products, and we thought that including some of them in our end-of-the-year issue would be more than appropriate. It also helped that Max, from Future's video team, wanted to build a new rig into an open-air case by In Win that he'd bought. So we figured: Why not? This is the Christmas issue, after all, so we decided to get into the spirit.

Most of the time, our builds end up in PC cases that enclose the guts on all six sides. Even if there is a side panel window, five out of six sides remain mostly or totally opaque. That means that the case is on display, not the parts inside. Seeing as the case costs only a fraction of the price of the PC, it's a shame to hide all those parts away behind sheets of black steel and aluminum.

We wanted to try out this open-air case because it gives us a chance to look at those parts that are too often hidden away. But with beauty comes pain. An open-air case like this one presented some unique challenges for our build.

Even with those challenges, we were happy with the final result, and hope that Max isn't too upset when we have to take back some of the parts and keep them in our lab. Sorry, Max.

Rounding up the parts

When we set out to do this build, we wanted to include some shiny new parts. This, of course, meant we had to go with Skylake; we've been overdue for a build that used Intel's latest architecture. For graphics, though, we had a choice. We could go lower-end with the recently released GTX 950, or go bigger with the AMD's R9 Nano.

Guess which way we went. With a $530 Core i7-6700K CPU in use, we chose the Nano to match, which fit well in this mini-ITX build. The CPU and GPU found a home on the Gigabyte GA-Z170N motherboard, which supports DDR4 and offers wireless networking too, with its mini-PCIe Wi-Fi card. We had an EVGA Z170 board, but the included Wi-Fi was a good reason to pick this board over the latter. We just wish that the motherboard came with on-board power and reset buttons, like the EVGA model. As this is a Z170 board, we had to go with DDR4 memory. We got a couple of 8GB sticks of 2,666MHz Corsair Dominator.

All of our parts found a comfy, airy home in the In Win D-Frame Mini. While Max chose the orange and blue frame, it also comes in black and red. The cool thing is that there's no clear top or bottom; you only need to worry about access to ports and buttons.

The 750W power supply is plenty for the parts we chose, and as mini-ITX is limited to one GPU, there's no need to worry about extra headroom for SLI or CrossFire. However, the extra wattage does allow for single-GPU upgrades or the addition of spinning drives.

INGREDIENTS

PART		STREET PRICE
CASE	IN WIN D-FRAME MINI (ORANGE)	$353
MOTHERBOARD	GIGABYTE GA-Z170N	$245
CPU	INTEL CORE I7-6700K	$530
MEMORY	16GB (2X 8GB) CORSAIR DOMINATOR PLATINUM DDR4 2666	$262
GPU	AMD RADEON R9 NANO	$1,149
PSU	BITFENIX FURY 750W 80 PLUS GOLD	$194
SSD	SAMSUNG 850 EVO 2TB	$969
CPU COOLER	DEEPCOOL MAELSTROM 240	$99
TOTAL		$3,801

1 HOT STUFF

The Radeon R9 Nano is quite a powerful GPU, given its tiny form factor. However, we noticed that it got pretty toasty when we ran our graphics benchmarks. While normal closed cases could solve this by channeling air through the case, we were low on options because there was no way to effectively push extra air over the card. The air coming from our CPU radiator was nice and cool, but the slight offset of the motherboard meant that the Nano wouldn't get any of the cool breezes. Placing the 'front' glass panel on the case helped a little bit, but the Nano breathes best with a little extra air flow from a case fan.

If we were to redesign the case, we'd like to see an extra removable bracket for a case fan, just below the GPU mount. This would better support the use of extra-toasty GPUs, which would usually have more forced air, to stay a little cooler under load.

2 SIDE MOUNTED

The PSU is the heaviest component in nearly any build, so mounting it on the side of the case might seem counter-intuitive. Not so, with the D-Frame. The PSU happily occupies a bracket on the side of the cage, but doesn't make the cage feel off-balance.

To make things neater, we went with individually sheathed cables, which are easier to manipulate. Routing the cables was a bit tricky with a smooth aluminium plate, instead of a motherboard tray rife with cable-management tie loops. Luckily, the cage came with a few accessories that helped.

We used a modular power supply, so there's no need to stash unused cables. That's a big deal in a case where there are no hiding places for your cabling.

3 USB 3.0 WOES

If there was one beef we had with this motherboard, it was the positioning of the USB 3.0 front panel connection. After you figure in the presence of a GPU, it became clear that there was no sexy, clean way to attach the cable.

To the left, you have the R9 Nano, and routing under the GPU between the PCIe slot and the 'back' panel was too tight a squeeze. If we came from below, the cable would have routed across the memory and CPU. We decided to run the cable over the 'top', which places it over a pair of USB ports and the Wi-Fi antenna connectors. The result was the best of a bunch of less-than-ideal options. If there's an upside, it's that the USB cable is braided, which makes it at least look good, even if it is in the way. Then again, some may like the appearance of cables jutting out of the motherboard, giving it a cybernetic look. We won't judge.

4 SILENT STORAGE

With the recent release of the 2TB Samsung 850 EVO, we thought it would be perfect for a mini-ITX build. Having two whole terabytes available on an SSD is pricey, but it has its advantages. It eliminates the need for a small HDD for Steam games or media files, and there's one less moving part to fail from frequent moves to and from LAN parties or events.

It's easy to forget that an enclosed case muffles the sound of fans, and hard drives searching for, reading and writing data. The high-speed clicks of the hard drive disappear when using an SSD, leaving only the CPU cooler and GPU as noise sources.

The black finish on the 850 EVO is similar to the finish of the aluminium mount of the D-Frame, which makes the slim SSD seem to disappear. The downside is that the drive is a little too far from the edge of the plate (two or three millimeters), which made it a bit hairy when we tried using an L-shaped SATA cable.

5 DOMINATING THE CAGE

When we looked for memory, we wanted to go big on capacity but we noticed that most of our DDR4 kits are 16GB, but in 4 x 4GB kits. Bummer. As we searched, we remembered that we had a machine that could donate a few sticks. We grabbed two 8GB sticks of Corsair Dominator RAM from our one of our older systems and used them.

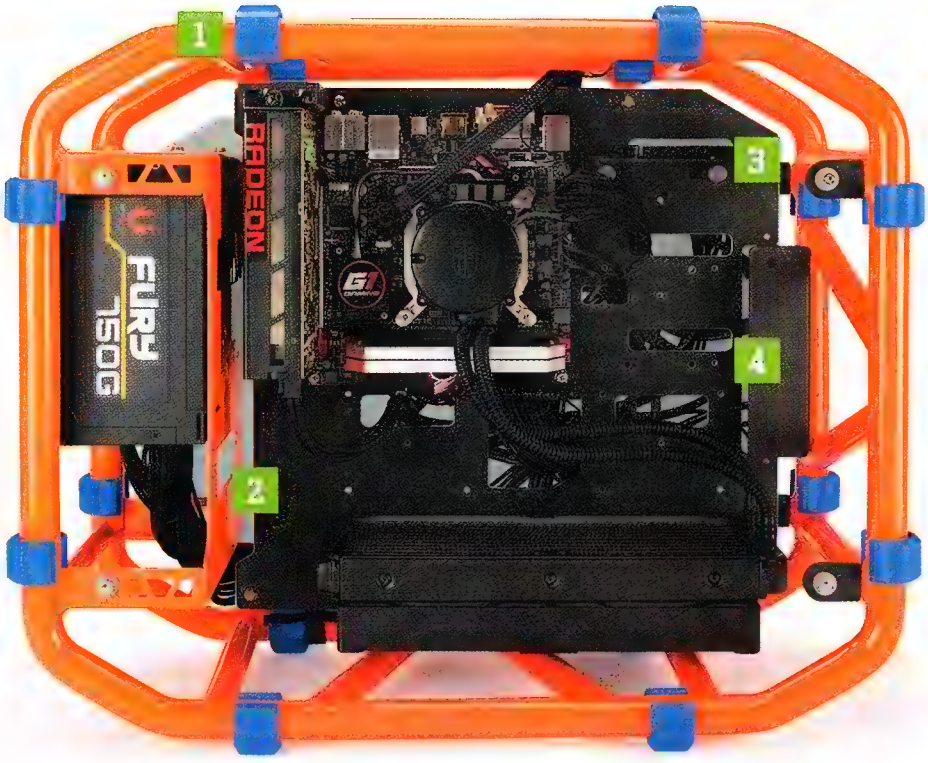
As with most X99 systems, our Z170 board from Gigabyte defaulted to setting the RAM clocks of the 2,666MHz sticks at 2,133MHz. The problem was solved by upping the multiplier for the RAM clock. Leaving it at 2,133MHz wouldn't have hurt performance much, as RAM clocks are rarely a bottleneck now. In other mini-ITX builds, going with 2,133MHz DDR4 RAM would be fine in most cases, and you'll save a little coin by forgoing higher RAM clocks.

6 ONE COOL CAGE

One of the neat things about this build was the way the cage accommodated our cooling solution. It comes with a bracket for a 240mm closed-loop cooler, which sits out of the way at the 'bottom' of the cage. We were able to get our Deepcool Maelstrom 240 snugly in the bracket, with nary a screw to secure it in place. Other coolers might not stay put with friction alone, so the eight screw holes can be used.

The Deepcool chiller was our backup choice, though. We tried using a bigger cooler, but for some reason, it wouldn't have good enough contact with our CPU, which resulted in some problems booting.

The main gripe we had using a 240mm cooler with this motherboard was the lack of PWN pinouts. There's no CPU_OPT or second case fan pinout, meaning we had to do something to get three PWM connectors to fit on two pinouts.



1 The blue rubber bumpers on the D-Frame Mini enable you to position the cage in any orientation you like. They also stop the case from sliding around in your car's trunk on the way to a LAN party.

2 The extra room below the PCIe slot allows for full-length video cards. In our build, the Nano leaves this area sparse and clear.

3 Thumb screws allow for the attachment and removal of hard drive and cooler brackets, for tons of modularity.

4 The 'front panel' is a bit of a misnomer in this cage, where there is no clear front, back, up or down.

Breaking out

Throwing all of these parts together in a cage was a lot of fun and was quite a different building experience. Such a build requires you to think more about the aesthetics of the build's entirety, since there's no hiding of cables or extraneous accessories here.

Like we said, though, an open-air case build is not without its challenges. One of those was the cooling system. We started off with a larger cooler that ended up not maintaining good contact with our CPU for some reason, so we had to go with the Deepcool we had on standby. Once we had the radiator and pump in place, we had three PWM connectors to plug in, but only two pinouts to work with.

We solved this in a roundabout way. First, we plugged the two fans for the radiator into the CPU and case fan pinouts. We then connected the pump to a two-pin Molex-to-PWM adapter. This had two consequences, which we weren't fond of. First, the two fans ran at different speeds, since each PWM pinout runs as a function of a different temperature sensor. The CPU fan is a function of CPU temps, as you'd expect, but the case fan takes temps from the motherboard itself. While we stayed at acceptably cool temperatures due to the large radiator, we wouldn't do this when overclocking, as the fan that was plugged into the case fan connector wouldn't rev up as temperatures increase. Not good.

The other side effect was that the water pump runs at full speed while connected to the two-pin adapter. Normally, you'd connect the pump to a four-pin pinout. However, we needed the pump to work, so we put up with this while we ran our benchmarks.

Our caged rig did pretty well in some aspects, while relatively poorly in others. In the single-threaded CPU benchmarks, the i7-6700K Skylake performed well, outpacing the i7-5960X in our zero-point. With a 240mm cooling setup, we believe this CPU could score even higher with overclocking. When we reviewed the CPU, the 6700K got a 17% boost from overclocking. Not bad at all.

When it came to the 3D application benchmarks, the little R9 Nano put up a good fight. Considering our beefy Labs test PC has three GTX 980s in SLI, a single GPU can hardly expect to beat it.

Despite having less than half the 3DMark score in Fire Strike Ultra, the Nano delivered playable frame rates in *Tomb Raider* and *Shadow of Mordor* at 4K. In *Batman: Arkham City* at 1440p, the 92fps means that there's plenty of power there to keep a FreeSync 1440p monitor synced and happy at 60Hz.

In the multithreaded test, x.264, the octa-core 5960X still reigns supreme, but for most gamers and enthusiasts who don't encode video all day, this build would perform nicely. And with its portable, unique form factor, it can be quite the conversation starter. ■

LABS BENCHMARKS

	LABS TEST PC	THIS SYSTEM
STITCH.EFX 2.0 (SEC)	806	781 (3.1%)
PROSHOW PRODUCER 5.0	1,472	1,442 (2.0%)
X264 HD 5.0 (FPS)	33.8	19.54 (-42.9%)
BATMAN: ARKHAM CITY 1440P (FPS)	204	92 (-54.9%)
TOMB RAIDER 2160P (FPS)	87.5	36.6 (-58.2%)
SHADOW OF MORDOR 2160P (FPS)	70.1	40.2 (-42.7%)
3DMARK FIRESTRIKE ULTRA	8,016	3,362 (-58.1%)

Our Labs test PC uses a Core i7-5960x CPU, three GTX 980s, and 16GB of RAM. *Arkham City* tested at 2,560 x 1,440 max settings with PhysX off. *Tomb Raider* tested at Ultimate settings. *Shadow of Mordor* tested at the maximum settings.

Pi is for Printing

Using the Raspberry Pi as a wireless print server is easy when you have a Raspberry Pi and CUPS. Mayank Sharma shows us how.

A printer isn't the most convenient of peripherals. They look out of place on most work desks and create quite a racket when spitting out pages. You could throw a few hundred quid on a snazzy new network printer that sits in a corner somewhere and can receive print orders from any computer on the local network or you could just hook your regular USB printer to the Raspberry Pi and enjoy the same conveniences offered by top of the line network printers.

If you haven't already used your printer on Linux, before you get started with this project head to **openprinting.org/printers** to check whether your printer is compatible with the *CUPS* printing server software. If your printer is listed, hook it up to the Raspberry Pi using one of the USB ports. For this project, we're using the Raspbian distro and the Pi is connected to the local network via a compatible wireless adaptor. However, you can also hook the Pi up to your network via the wired Ethernet port.

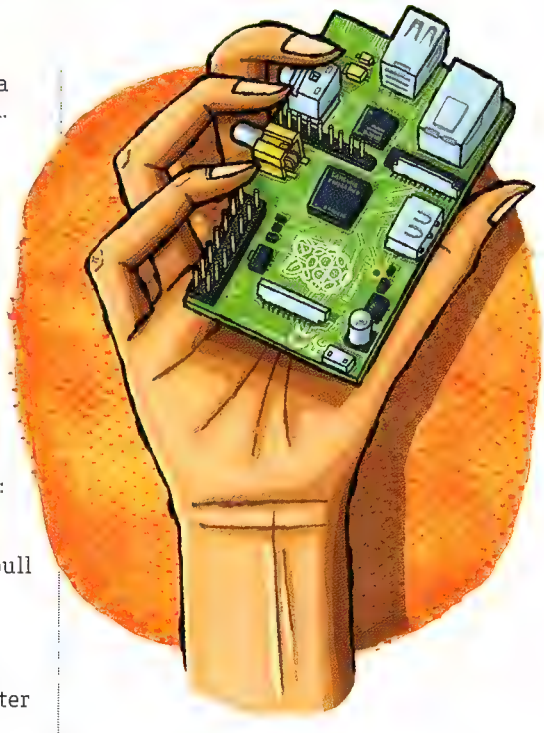
You can follow the instructions in this tutorial by accessing the Raspberry Pi remotely from any other computer on the network. Just make sure that the SSH server inside Raspbian is enabled by using the *raspi-config* tool. It's also a good idea to assign a fixed IP address to the Pi. You can do this easily from within your router's admin page. For this tutorial, we'll assume that the IP address of your PI is **192.168.3.111**. You can now access the Pi from within Windows using the *PuTTY* client or from any Linux distro with the SSH CLI command with:

```
$ sudo ssh
pi@192.168.3.111
```

INSTALL CUPS

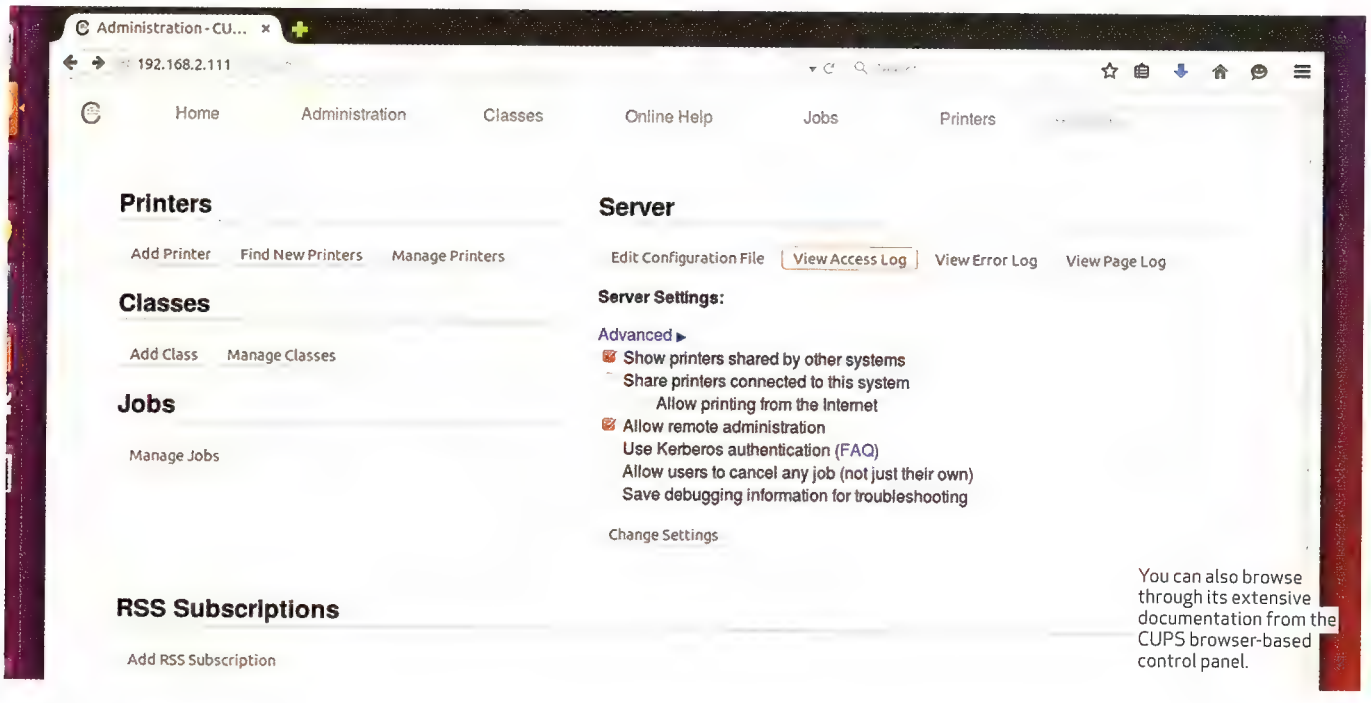
Once you're inside Raspbian, update the repositories (repos) with: `$ sudo apt-get update` and then install any updates with: `$ sudo apt-get upgrade`. Now, pull in the CUPS print server with: `$ sudo apt-get install cups`.

When it's installed, add your user to the group created by *CUPS* called 'lpadmin' that has access to the printer queue. Unless you have created a custom user, the default user on Raspbian is called pi. Use the following command to allow it to interact with the printer: `$ sudo usermod -a -G lpadmin pi`. Here we use the *usermod* tool to add (`-a`) the pi user to the lpadmin group (`-G`). By default, *CUPS* can only be configured from the local computer that it's installed on.



Because that doesn't work in our case, we need to edit its configuration file to allow us to make changes to the server from a remote computer. First of all, you need to create a backup of the original configuration file with:

```
$ sudo cp /etc/cups/cupsd.
conf /etc/cups/cupsd.conf.orig
```



You can also browse through its extensive documentation from the CUPS browser-based control panel.

CUPS command-line utilities

The *CUPS* printing system ships with a number of nifty little command-line utilities. In fact, you can set up and configure all aspects of your printer from the CLI. Let's run through some of the most useful commands that will help you manage the printer better.

We've already seen the `lp` command, which queues a file for printing on the default printer. The default printer is specified in the `PRINTER` variable. You can specify it with the command `export PRINTER=printer-name` where `printer-name` is the name of the printer you specify in step two of the walkthrough. If you have multiple printers, use the `-d` option to specify the printer you wish to print to. For example, `lp -d HP-printer file.txt` prints the file on the HP printer, which isn't set as the default.

To influence the characteristics of the printed output, use the `-o` option to specify a variety of options. For example, `lp -o landscape -o fit-to-page -o media A4 file.jpg` fits the image into A4 size specifications and prints it in landscape mode. Refer to the *CUPS* documentation (**www.cups.org/documentation.php/options.html#OPTIONS**) for a list of all the supported printing options.

If you mistakenly print a large file and want to stop the print job before you waste too much paper, you can use the `lpq` command to print a list of all the print jobs currently in the queue.

The command also lists the file that each job is printing and its size, so you can easily identify the job ID assigned to each. Make note of it because you need it to cancel the print job. The command `cancel 2`, for instance, cancels the job with the ID 2.

Then open the file with the *nano* text editor `$ sudo nano /etc/cups/cupsd.conf`. Inside the file, scroll down to the following section:

```
# Only listen for connections from the local machine
Listen localhost:631
```

Comment out that line and add another to ask *CUPS* to accept connects from any computer on the network. Make sure the section looks like this:

```
# Only listen for connections from the local machine
# Listen localhost:631
Port 631
```

Then scroll further down in the configuration file until you reach the `<Location>` sections, and add a new line that reads `Allow @local` just before the close of the section. The section with the appended line should now read like this:

```
< Location / >
# Restrict access to the server
Order allow,deny
Allow @local
< /Location >
```

Now add the `Allow @local` line to the other two `Location` sections – `<Location /admin>` and `<Location /admin/conf>`. Save the file and restart the *CUPS* server with: `$ sudo /etc/init.d/cups restart`.

You should now be able to access the *CUPS* administration panel via any computer on your local network by pointing the web browser to your Pi. Then follow the walkthrough over the page to add your printer to *CUPS*.

Some Linux distros ship with a restrictive iptables firewall policy that doesn't allow connections via the *CUPS* ports. Even if Raspbian doesn't, make sure it doesn't throw up any unexpected errors by punching holes in the firewall with:

```
$ sudo iptables -A INPUT -i wlan0 -p tcp -m tcp --dport 631 -j ACCEPT
$ sudo iptables -A INPUT -i wlan0 -p udp -m udp --dport 631 -j ACCEPT
```

If you connect to the Raspberry Pi via Ethernet instead of a wireless adaptor, modify the command and replace `wlan0` with `eth0`. When you are through setting up your printer using the *CUPS* administration panel, it's time to make it accessible to other machines on your network. While Linux distros will have no trouble detecting your new network printer, making them visible to Windows and Apple devices requires a couple of extra steps.

NETWORK-WIDE ACCESS

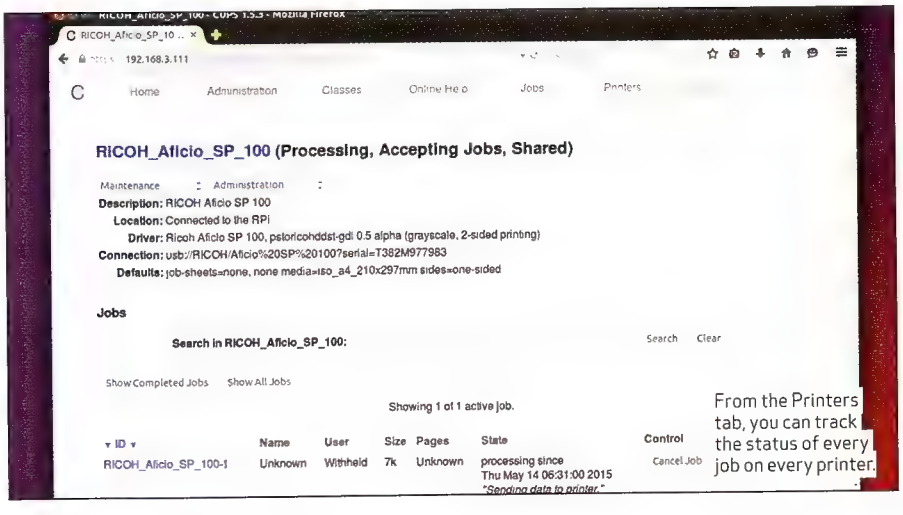
For Windows, install the Samba server on the Pi with `$ sudo apt-get install samba`. Then open its configuration file (**/etc/samba/smb.conf**) in the nano text editor and hunt for the section labelled `[printers]` and make sure it contains the line: `guest ok = yes`. Then scroll down to the `[print$]` section and change its path to the following:

```
path = /usr/share/cups/drivers
```

Then scroll up to the `Global Settings` section at the top of the configuration file. Modify the workgroup parameter within to point to the name of your workgroup, which by default is named `WORKGROUP`. Also enable the wins support by adding the line `wins support = yes`.

Now save the file and restart *Samba* with `$ sudo /etc/init.d/samba restart`.

Then head over to the Windows machine and launch the Add New Printer wizard and click on the option to install a network printer. Thanks to the modified *Samba* configuration, the wizard will detect and list any printers hooked up to the Pi. If you have Apple devices, you can enable support for Apple's AirPrint system, which allows you to print from the iPad and iPhone. For this, just install the *Avahi* daemon with `sudo apt-get install avahi-daemon` on the Pi, which will then make the connected printer visible to AirPrint-compatible devices. In addition to the ability to use our



From the Printers tab, you can track the status of every job on every printer.

network printer from within graphical applications across all platforms, we can also use it to print from the command line interface. We can also interact with the printer using the Python programming language.

PRINT FROM PYTHON

The CUPS printing server installs a bunch of command-line tools for interacting with the server and any connected printers. You can send files to the printer using the `lp` command, such as:

```
$ lp ~/docs/a_text_file.txt
```

If you have multiple printers, you can print to a specific printer by specifying its name, such as:

```
$ lp ~/docs/another-text.txt
-d EPSON_LX-300
```

When you use the commands with a PDF or image file, *CUPS* converts the files using the printer drivers. You can also use Python to generate printer-friendly content. This is best done by using the PyCups library, which provides Python bindings for the *CUPS* server. Install the library with:

```
$ sudo apt-get install
python-cups
```

Then create an `example.py` Python script with:

```
import cups
conn = cups.Connection()
printers = conn.getPrinters()
for printer in printers:
print printer,
printers[printer]["device-
uri"]
```

The script fetches details about all the printers managed by *CUPS* and prints their name and device address to the screen. When you execute the script, it produces an output similar to the following:

```
EPSON_LX-300 usb://EPSON/
LX-300+?serial=L0102090B1
RICOH_Aficio_SP_100 usb://
RICOH/
Aficio?serial=T382M977983
```

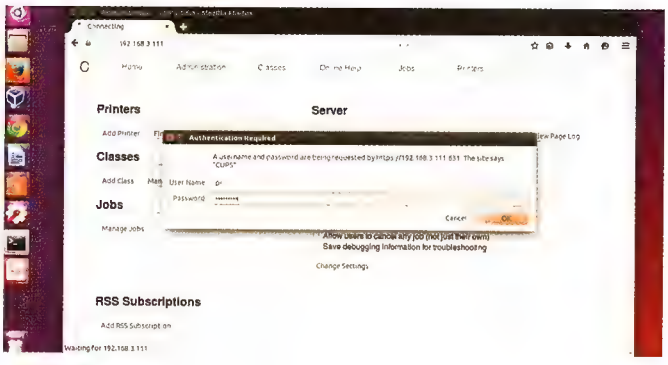
You can also print files from the Python script using the printFile function, by specifying them in the format:

```
$ printFile (name of the
printer, filename to print,
job title,
options)
```

Open the previous `example.py` script and add the following lines to it:

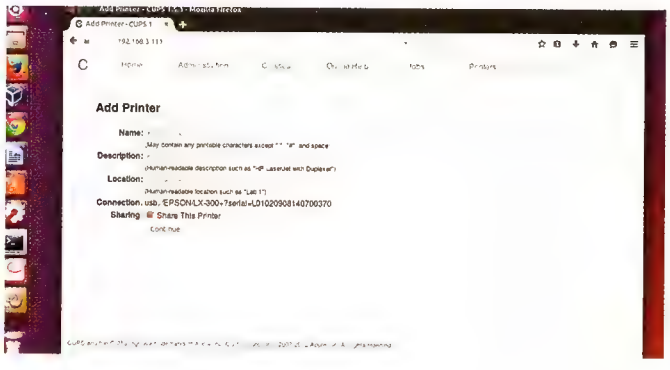
```
file = "/home/pi/testfile.
txt"
printer_name=printers.keys()
[0]
conn.printFile (printer_name,
file, "Project Report", {})
```

Add a printer



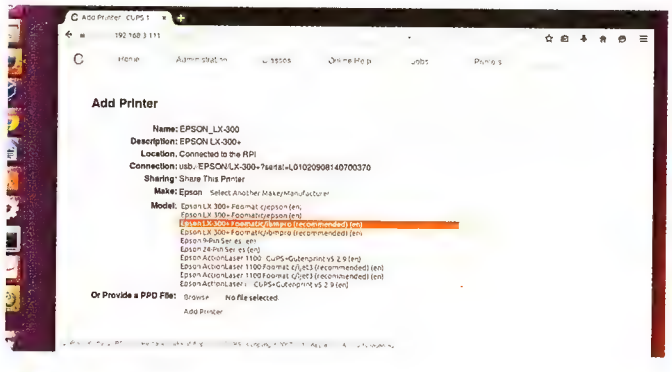
1 THE CUPS DASHBOARD

The *CUPS* print server includes a built-in web server that powers its configuration panel. It's running on port 631 on the Raspberry Pi, which in our case is 192.168.3.111:631. Access the address from any browser on the network. You have to accept its security certificate and then log into the interface using the credentials of the user that you've added to the lpadmin group, which in our case is the pi user.



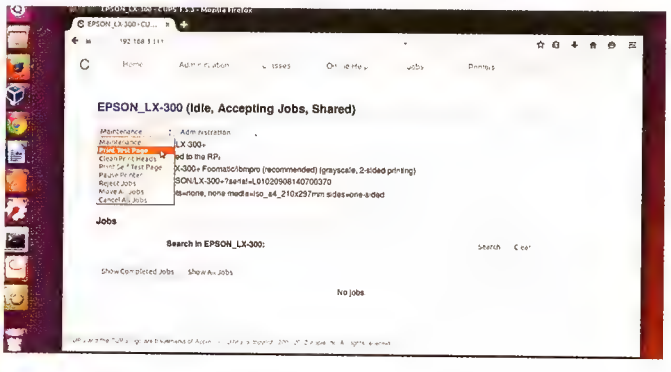
2 ADD A PRINTER

Once logged in, switch to the Administration tab and click on the 'Add Printer' button, which brings up a list of printers. Toggle the radio button next to your printer and head to the next step. Here you'll be asked to add or edit the name, description and location of the printer. Make sure you enable the 'Share This Printer' option to make the printer accessible all over the network.



3 SELECT A DRIVER

In the next step, you're asked to choose a driver for the selected printer. *CUPS* shows you a list of drivers based on the make of printer. Chances are that several of the drivers are marked 'Recommended'. However, scroll through the list until you find the driver for your exact model. Alternatively, if you have a PPD file for the printer's driver, click on the 'Browse' button and navigate to it.



4 SET DEFAULT OPTIONS

In the final step, *CUPS* enables you to set some generic print settings, such as page size and source. The number and type of options vary from one printer to another, and might spread over several sections. When you've finished setting your preferences, click Set Default Options. You're then taken to the main administration page for that printer. Use the Maintenance pull-down menu to print a test page.

The first line saves the name of the file you wish to print inside a variable named `file`. The second line fetches the list of printers and saves the first name, which is the default printer inside a variable named `printer_name`. The third line then uses the first two variables and prints the file in the specified format.

CONVERTING FROM HTML TO PDF

A more interesting way to convert HTML pages into PDF file is to use the wkHTMLtoPDF toolkit, which passes on the PDF to the printer from within a Python script.

Before you can install the toolkit, first install the required components and a set of fonts to process the web pages:

```
$ sudo apt-get install xvfb
xfonts-100dpi xfonts-75dpi
xfonts-scalable xfonts-
cyrillic
```

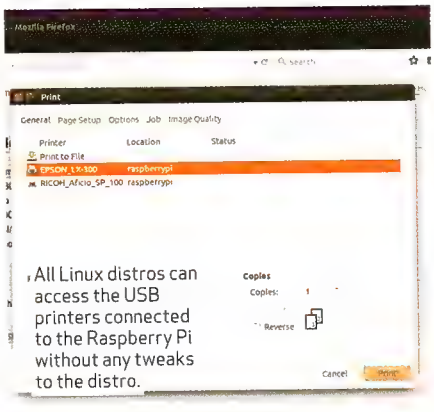
then install the tool with:

```
sudo apt-get install
wkhtmltopdf
```

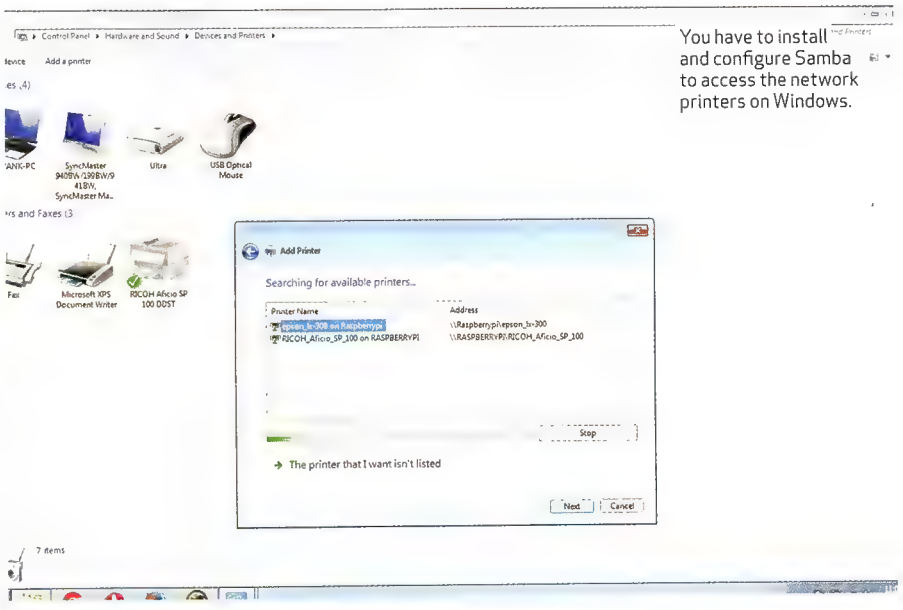
before installing the Python wrapper with:

```
$ sudo pip install
git+https://github.com/qoda/
python-wkhtmltopdf.git
```

You can now use the following to convert a web page into a PDF file:



All Linux distros can access the USB printers connected to the Raspberry Pi without any tweaks to the distro.



You have to install and configure Samba to access the network printers on Windows.

```
from wkhtmltopdf import
WKHtmlToPdf
wkhtmltopdf = WKHtmlToPdf (
    url='http://www.
linuxformat.com',
    output_file='/home/pi/
docs/lxf.pdf',
)
wkhtmltopdf.render()
```

When executed, the above code saves the main page of the Linux Format website into a PDF file under the /home/pi/docs directory.

Refer to the listing below to see how all the pieces fit together — *wkHTMLtoPDF* converts a page into a PDF and prints it out.

```
#!/usr/bin/env python
import cups
from wkhtmltopdf import
WKHtmlToPdf
wkhtmltopdf = WKHtmlToPdf(
    url='http://www.
techradar.com',
    output_file='/home/pi/
techradar.pdf',
)
wkhtmltopdf.render()
conn = cups.Connection()
printers = conn.getPrinters()
for printer in printers:
        print printer,
printers[printer]["device-
uri"]
file="/home/pi/techradar.pdf"
printer_name=printers.keys()
[0]
conn.printFile (printer_name,
file, "PDF Print", {})
```

The script first converts the **techradar.com** home page into a PDF. It then connects to *CUPS*, prints a list of attached and configured printers on the screen, and uses the default printer to print the PDF. The PyCups library is chock-full of methods (**https://pythonhosted.org/pycups**) that you can use to control all aspects of the *CUPS* print server.

Happy hacking!

Administering CUPS

In addition to adding printers, the *CUPS* web interface provides access to various other useful settings. You can administer most of the printing tasks from the Administration tab, which houses settings under various different categories. Under the Server section, for instance, you can find options to tweak the configuration of the server, as well as view various types of access and error logs.

Using the 'Manage Printers' button under the Printer section, you can control the settings for individual printers. Every printer's page has options rolled under two pull-down menus labelled Maintenance and Administration. From under the Maintenance menu, you can print a test page, a self-test page, clean print heads and manage print jobs.

To customise the behaviour of the printer, use the Administration menu to tweak its default options, set it as the default printer, restrict user access, modify its settings or delete it from the CUPS server altogether. Besides the Administration tab, there are a couple of other important tabs we should mention as well.

For starters, you need to switch to the Classes tab for printer class management. A class is a collection of several printers.

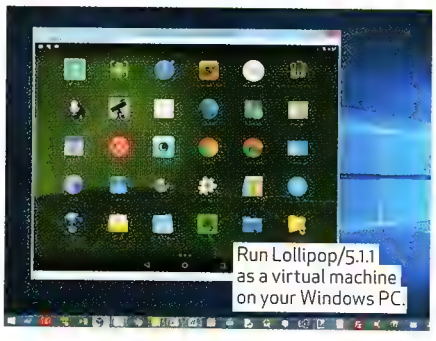
When you send a print job to a class, *CUPS* automatically assigns the job to the next available printer, instead of waiting for a specific printer. Then there's the Jobs tab, which enables you to view and manage all print jobs that are currently in the print queue. ■

Virtualise Android Lollipop on your Windows PC

Can't get Android 5.1.1 on your mobile device? Run it as a virtual machine on your PC instead. Darren Yates shows how to do it all for free.

Thanks to the lucky dip that is Android updates, the Android Community has become extremely adept at porting the latest versions of Google's mobile OS onto an ever-growing number of devices supposedly long past their used-by date. My Samsung Galaxy S3 powered by the latest Lollipop/5.1.1 is proof enough.

But a useful side-option is running Lollipop on your Windows PC – not as a dual-boot, but as an actual Windows app. Combine the goodness of Android-x86 and Oracle's VirtualBox virtualisation tool and that's exactly what you can do. It won't play Angry Birds or Clash of Clans, but you'll be able to run a heap of Android apps inside a Lollipop virtual device right on your Windows desktop. Here's how.


Run Lollipop/5.1.1 as a virtual machine on your Windows PC.

WARNING

Creating a virtual machine requires hard drive space to create a virtual disk. Make sure you understand the process before you begin. While we have tested this successfully numerous times, you use this process at your own risk.

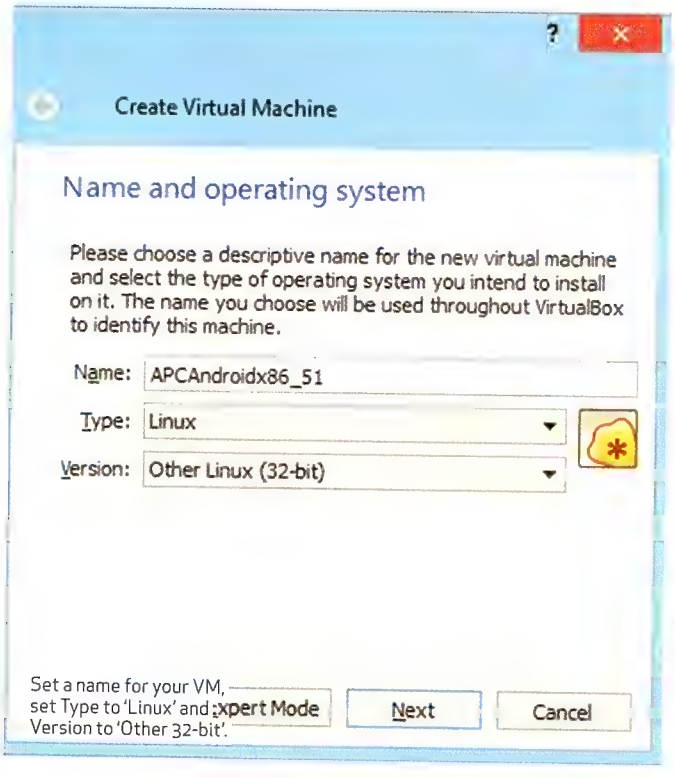
WHAT YOU'LL NEED

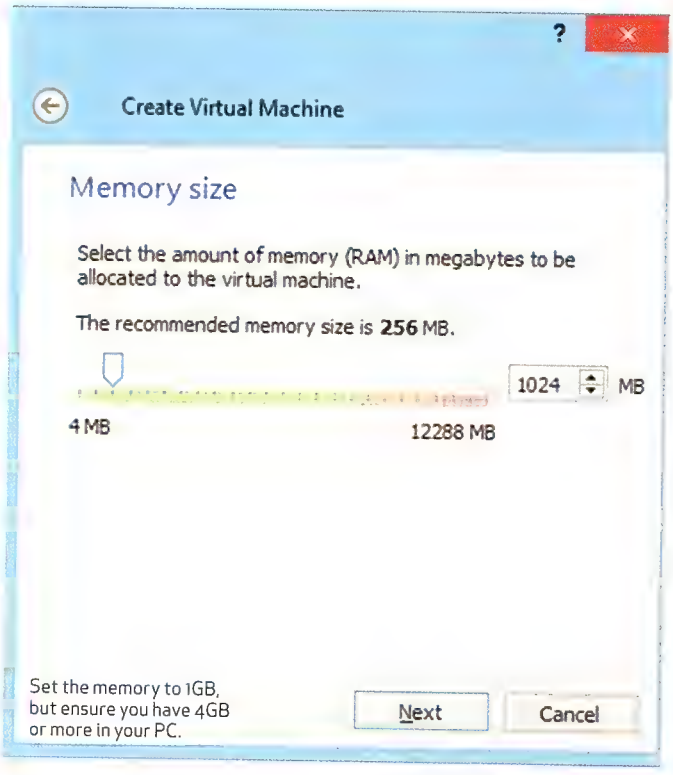
In terms of hardware, you'll need a Windows 7 or later PC with at least 4GB of RAM and 20GB of free hard drive space (you'll use 1GB of RAM and 8GB of that drive space with default settings). Start by grabbing the software, installing VirtualBox and launching it.

CREATING THE VIRTUAL MACHINE

This is fairly straightforward, but here's a quick walkthrough. You begin by selecting New from the menu and on the Create Virtual Machine window, give your VM a name (no spaces), set the Type to 'Linux' and Version to 'Other Linux 32-bit'. Press Next.

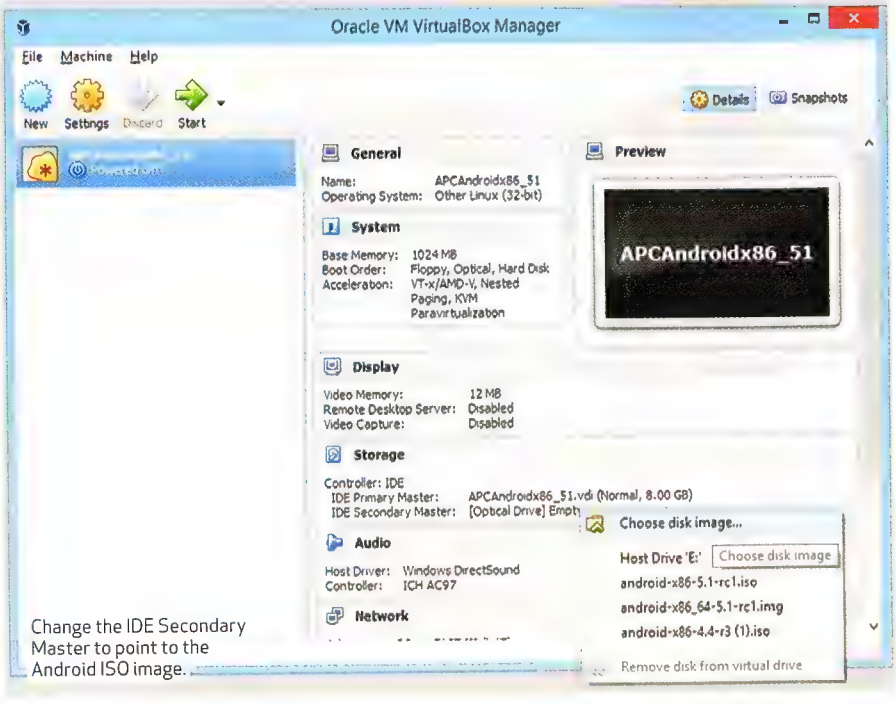
Now set the Memory Size slider on the following screen to 1GB (1,024MB) and tap the Next button. VirtualBox will default the virtual hard disk size to 8GB, which is fine to start with, so just press the Create button. Next, use the default VDI (VirtualBox Disk Image) format and press Next, also use the default 'Dynamically allocated' storage option and press Next again. You can choose the file location and set the drive size on the next window if you wish, but just press Create and it will store the VM files in the standard /user/<username>/virtualbox subfolder.


Create Virtual Machine
Name and operating system
Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.
Name: APCAndroidx86_51
Type: Linux
Version: Other Linux (32-bit)
Expert Mode
Next
Cancel
Set a name for your VM, set Type to 'Linux' and Version to 'Other 32-bit'.


Create Virtual Machine
Memory size
Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.
The recommended memory size is 256 MB.
1024 MB
4 MB
12288 MB
Next
Cancel
Set the memory to 1GB, but ensure you have 4GB or more in your PC.

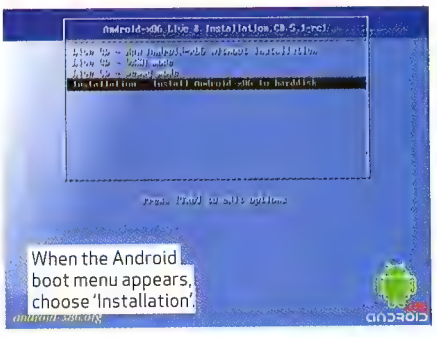
Get the software

Make sure you download the required software — it's free:
Android-x86 5.1.1 Lollipop 32-bit ISO image — **http://sourceforge.net/projects/android-x86/files/Release%205.1/android-x86-5.1-rc1.iso/download**
Oracle VirtualBox 5.0 — **www.virtualbox.org**



Change the IDE Secondary Master to point to the Android ISO image.

Please select a virtual optical disk file or a physical optical drive containing a disk to start your new virtual machine from.
The disk should be suitable for starting a computer from and should contain the operating system you wish to install on the virtual machine if you want to do that now. The disk will be ejected from the virtual drive automatically next time you switch the virtual machine off, but you can also do this yourself if needed using the Devices menu.
Host Drive 'E:'
Host Drive 'E:'
Start
Cancel
On booting your VM for the first time, select the Android ISO as boot disk.


When the Android boot menu appears, choose 'Installation'.

Once you've stepped through that lot, you'll be back at the VirtualBox screen with your virtual machine (VM) created.

LOADING IN THE ISO IMAGE

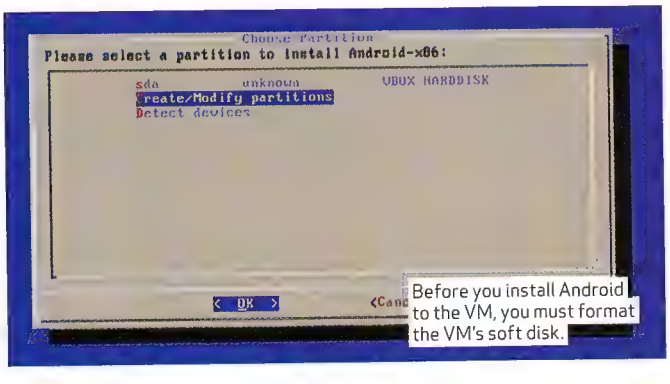
Now it's time to load the OS — to set it so the OS boot menu fires when we launch the VM, look for the Storage groupbox on the VirtualBox Manager screen, right-click on the IDE Secondary Master (which should be labeled '[Optical Drive] Empty') and choose the location of your Lollipop ISO image. As soon as you select it, the 'Empty' should be replaced by the ISO filename. Now just select your Android VM from the left list and press the green Start arrow button. You'll be asked to select a start-up disk, so choose the Android ISO file from the drop-down list and click the Start button. This should launch the VM and boot the live ISO image — within a second or two, the blue Android boot menu should appear.

Left-click inside the VirtualBox Android screen to transfer mouse control from your Windows PC to the VM — to get it back, the default control should be the right Control keyboard key. Press it once and your mouse should move back into Windows-world.

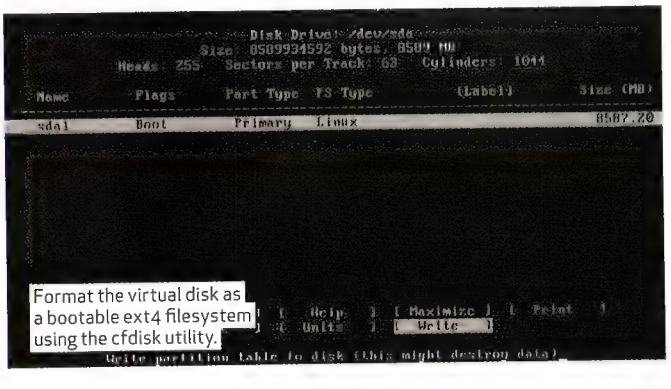
Feel free to run the LiveCD option to try things out; however, you won't be able to save anything (there's no persistence), so use the keyboard arrow keys and select the Installation option. What you'll see next is the Android-x86 drive partition/formatting utility with an entry something like 'sda unknown VBOX HARDDISK' highlighted. You don't want that one — down-arrow to Create/Modify partitions and choose this one instead. Next, you'll be asked if you want to use a GPT partition table. Choose No and press Enter. This will bring up the cfdisk formatting utility.

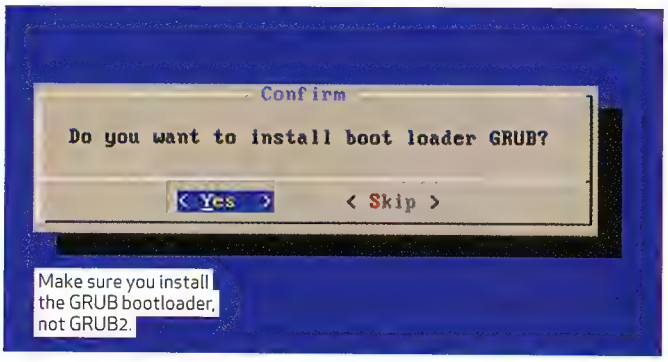
FORMATTING THE DRIVE

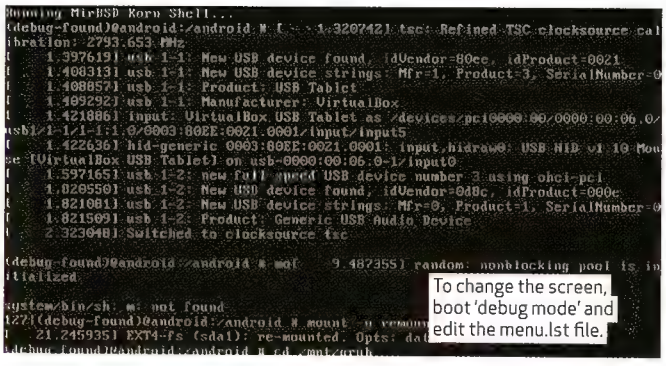
Cfdisk's command menu operates by left- and right-arrow keys, while to select the drive partitions, you use the up- and down-arrow keys. First things first, pressing the Enter key confirms all commands, so start by selecting New to create a new partition and press Enter. Choose Primary, use the

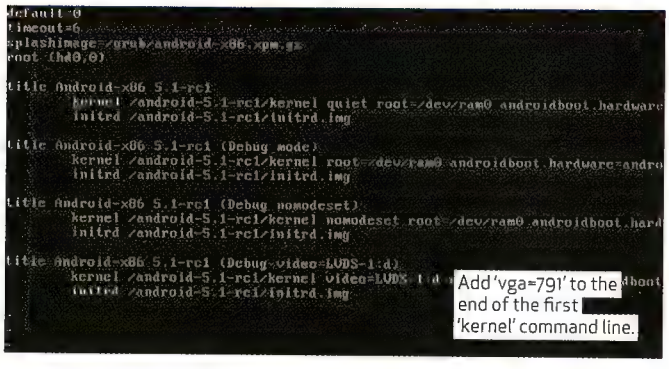


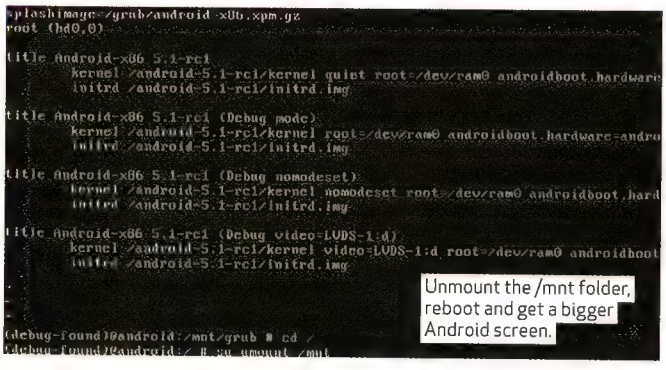
Before you install Android to the VM, you must format the VM's soft disk.


Disk Drive: /dev/sda
Size: 8509934592 bytes, 8509 MB
Heads: 255 Sectors per Track: 63 Cylinders: 1044
Name Flags Part Type FS Type [Label] Size (MB)
sda1 Boot Primary Linux 8507.20
[Help] [Maximize] [Print]
[Units] [Write]
Write partition table to disk (this might destroy data)
Format the virtual disk as a bootable ext4 filesystem using the cfdisk utility.









"You're creating a computer as a software app and file, not modifying a physical partition."

full displayed partition size (8587.19MB). Next, select Bootable to make the disk bootable and finally, choose the Write command to make it all happen (cfdisk will still require you to confirm this step by typing 'yes').

You'll get "warning – your disk will be erased" signs at this point, but what you're doing is created a 'soft' hard drive, which is really just a file on your Windows computer. This is why I love virtual machines much more than dual-booting – not only can you run two OSs at the same time, it's also inherently easier to deal with because you're creating a computer as a software app and file, not modifying a physical partition.

Anyway, now choose Quit and you'll go back to the Select Partition window we had before. This time, choose the 'sda1' option and hit the OK button. Next, you need to select the 'ext4' filesystem option (again, press the OK button), choose 'Yes' to formatting the partition and press Enter.

After that, you have to install the GRUB boot loader, so on this screen, choose 'Yes' and again press Enter. Skip installing EFI GRUB2 – we don't want it. Finally, choose 'No' to having the system folder as read-write and the ISO image should begin writing to the 8GB 'partition'.

You know you're done when you see the 'Run Android', 'Reboot' menu. But at this point though, do neither – press the right Control key to get back to Windows and on the VirtualBox Android VM Window menu, select File, Close and ensure the 'Power off the machine' option is selected.

FIRST BOOT

There's one last thing we need to do before we first-boot our new VM and that's to right-click on the IDE Secondary Master option again in Storage and select 'Remove disk from virtual drive'. We no longer need the ISO image and it'll just boot-loop if we leave it there.

With that done, select the Android VM again from the left list in VirtualBox Manager, hit the green Start button and launch the VM again. This time, you'll get the Android 5.1.1 menu and, after a five-second countdown, the OS should auto-launch and show you the big white Android logo. It'll take about a minute or so to sort itself out, but eventually, you'll get the Welcome screen.

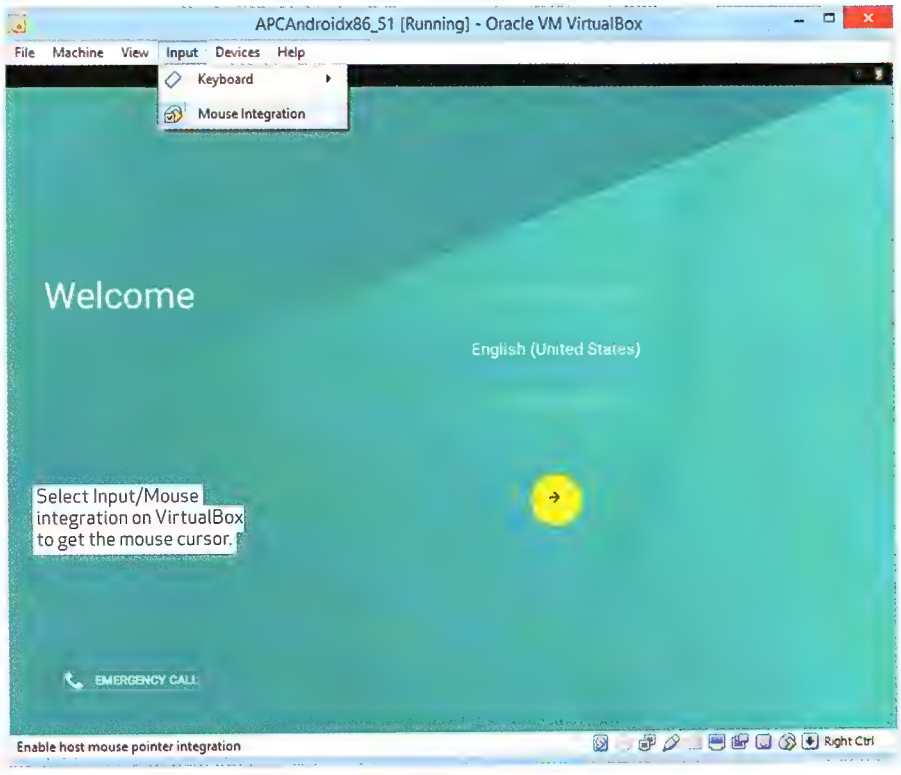
The rest should be fairly familiar, but just a couple of tips. First, in VirtualBox's VM window menu, choose Input, Mouse Integration to switch from Windows to Android mouse cursor. Click inside the VirtualBox window, move the mouse (you must move it) and the cursor will appear. Second, forget SIM cards and Wi-Fi networks – VirtualBox automagically reroutes Android's network needs through your Windows PC.

BUILT-IN GOODIES

From there, just follow the Android setup routine as you normally would. What's cool about Lollipop Android-x86 RC1 is that it comes with working Google Play and Gmail, so you have a squillion apps and your email ready to go. It's also root-ready – whether you consider that a good thing or not is up to you. But best of all, you now have persistence, so apps installed will stay installed when you shut down and reboot the virtual machine.

WHAT APPS WORK AND DON'T WORK?

Given this is a first 'release candidate' (it only hit the web at the beginning of October 2015), it's surprisingly stable and well-stocked. As soon as you hit the launcher screen, you should see your email and backed-up apps begin downloading in the background (something to be aware of if you're on mobile broadband). But what you won't get working are big-name games like *Angry Birds* or *Clash of Clans*. Unfortunately, VirtualBox doesn't virtualise Android graphics beyond the basics. Low-octane games should work, but anything involving OpenGL probably not.



GETTING A BIGGER SCREEN

You'll no doubt notice VirtualBox only gives you a default 800 x 600-pixel window for your virtualised Android but there is a temporary work-around. Reset your Android VM to restart it and load the Android menu. Before the five seconds are up and it runs the default option, press a down arrow key to toggle off the auto-load option, make sure you go back to the first '5.1-RC1' option, then press the E key – this switches into command-edit mode.

You should now see two command lines, one starting 'kernel', the other 'initrd' (initial ram drive). Make sure the 'kernel' command is highlighted and press E again. This gives you a very basic BASH command editor and dumps you at the end of that command line. Now type a space and `vga=791` (must be lowercase), press Enter and the B key to reboot.

GRUB is the Linux bootloader that launches the Android OS and allows you to choose video modes by number. The code '791' denotes 1024x768-pixels and 16-bit colour, '794' is 1280x1024-pixels/16-bit. Unfortunately, as we said, this is only temporary – reboot the VM and it'll go back to default 800x600-pixels.

EDITING MENU.LST

The permanent solution requires some Linux command line jujitsu. Here's what you do:

STEP 1. Reboot the Android VM, but in the boot menu, select the first 'debug mode' option. Let it spin through the command-line info for a few seconds until it stops. Press the Enter key and you should see the Linux command prompt.

STEP 2. We need to edit that boot menu and, to do that, we have to load up or 'mount' the grub subfolder as a rewriteable folder, so on the command prompt, type:

```
mount -o remount,rw /mnt
cd /mnt/grub
vi menu.lst
```

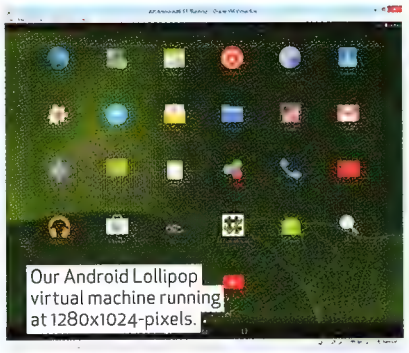
Press the Enter key at the end of each line. Vi is a teeny-tiny text editor built into almost every Linux distro and, after that last line, you should see the menu text appear in the editor. Press the I key to go into Vi's insert mode. Next, move the cursor to the end of the first kernel line and add the text `vga=791` (remember, this is 1,024 x 768- pixels at 16-bit colour, change it to `vga=794` for 1,280 x 1,024-pixels).

Press the Escape key to go back to control mode (character at the bottom left of the panel will go from 'I' to '-') and hit Shift-ZZ to save the changes. This should drop you back to the Linux command prompt at the same time.

STEP 3. Now we clean up our doodling with the following commands:

```
cd /
su umount /mnt
reboot -f
```

On hitting the Enter key the last time, the VM should reboot and, as soon as you select the first 'Android' menu entry, the VM should launch into your desired resolution as a permanent feature.


Our Android Lollipop virtual machine running at 1280x1024-pixels.

CHANGING BACK AGAIN

If you decide to change the screen resolution later, just follow the same procedure again and either change the VGA number or simply remove the 'vga=xxx' text altogether. Again, remember it is 'vga', not 'VGA'. Use capital letters and it won't work.

If you set the VM to 1,280 x 1,024-pixels, you need at least a 1,920 x 1,200-pixel monitor to view it correctly due to the VirtualBox app frame. If you only have a 1080p monitor, choose the 'vga=791' option and a 1,024 x 768-pixel frame size instead.

GETTING SOUND

One last thing – VirtualBox will use your PC's integrated audio, but if you use a USB audio device, you'll need to tell the app to use it. Power off your Android VM and make sure your USB audio device is plugged into the PC, ready to go. Next, go to the VirtualBox Manager, click on the Android VM, select Settings from the menu. Choose USB from the left menu on the new Settings screen and click on the icon second from the top on the far right side with the '+' sign. This will add any USB devices, including audio, to the setup and allow the Android VM to use them. The only problem is that the Android VM has no volume controls and VirtualBox doesn't route Android audio through Windows Audio controls, so it pretty much just gives you full-bore audio levels.

ZERO-COST ANDROID

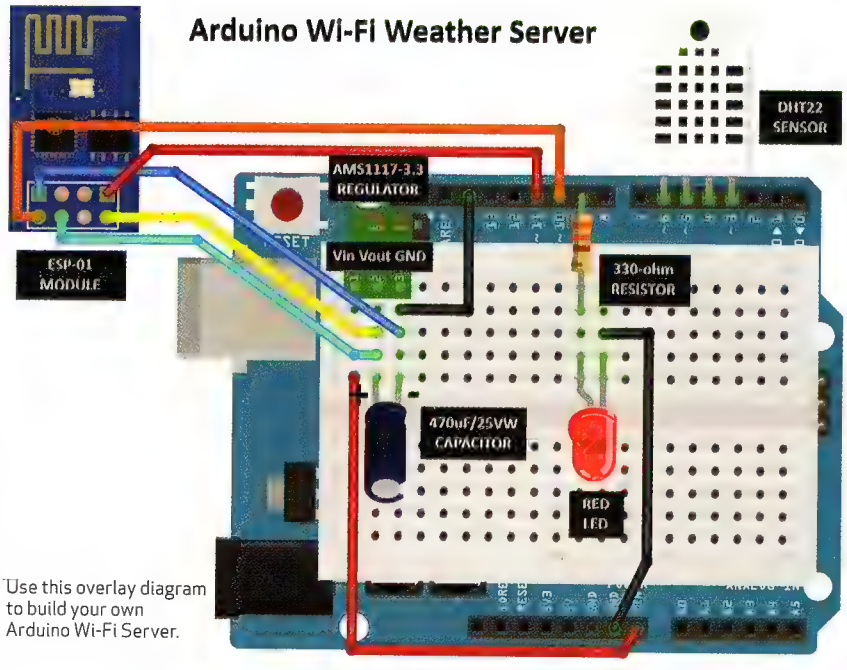
But the ultimate value here is that you can have your own Android Lollipop setup running as an app on your Windows PC and it's completely free. So even if your favourite phone or tablet can't run Lollipop, you can build your own PC setup using virtualisation.

Arduino Wi-Fi — Part 2

Turn your Arduino into a wireless web server using a new cheap 802.11b/g/n Wi-Fi module. Darren Yates shows you how with a remote weather server.

Last month, we introduced you to the new ESP8266 Wi-Fi chip from Espressif Systems that adds 802.11b/g/n Wi-Fi to your Arduino projects for less than $4. We looked at how it uses a modified set of modem-style AT commands to communicate with your Arduino and came up with a simple communications app that lets you talk to the ESP8266-powered ESP-01 Wi-Fi module.

This month, we get a little more serious and turn a DHT22 environment sensor, an Arduino Uno board and the ESP-01 module into a standalone Wi-Fi Weather Server.



Use this overlay diagram to build your own Arduino Wi-Fi Server.

THE CIRCUIT

We're using last month's circuit setup for this server, with just the addition of the DHT22 environment sensor. Normally, this sensor requires separate power connections, but we've coded the Arduino to power the DHT22 through its digital I/O lines, ensuring all we need to do is slot the sensor into the Arduino's D3 to D6 pins and it's ready to go. The DHT22 consumes only a trickle of current, low enough to be supplied direct from the digital I/O lines. By setting I/O pins D6 'high' and D3 'low', we create a teeny-tiny power supply that's perfect for the DHT22.

The ESP-01 Wi-Fi module requires 3.3VDC power, but the Arduino Uno itself runs off 5VDC, so we've added a tiny three-pin AMS1117 3.3VDC regulator, turning the 5VDC into 3.3VDC to power the ESP-01. These regulator modules are everywhere on eBay for around $1.50. (Yes, the Arduino Uno does have a 3.3VDC voltage source, but it can't deliver the current bursts the ESP-01 requires when transmitting, so we've gone for the AMS1117 regulator instead.)

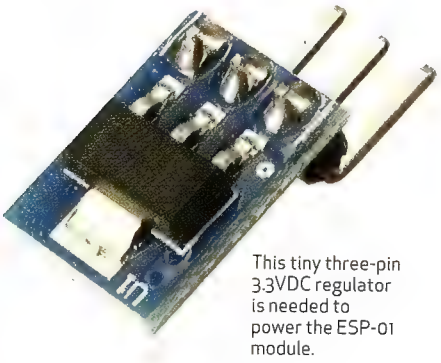
Finally, the whole thing is built on a DIY prototype shield — we've used one of these before and they're fantastic for building your own small circuits and adding them neatly to your Arduino board. It's about $5 on eBay. The overlay diagram should help you figure out how to build your own version.

GET THE SOURCE CODE

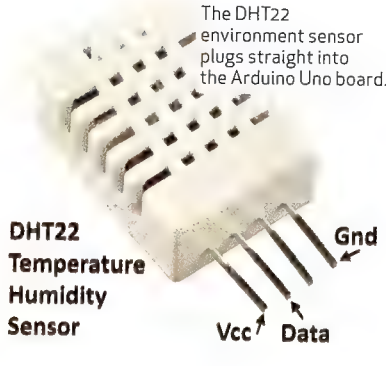
You can grab the WiFiWeather_v3 source code free from **apcmag.com/magstuff**. Unzip the file and copy the contents of the libraries subfolder to the same subfolder of your Arduino IDE. Restart the IDE and load up the WiFiWeather.ino source code. Next, build the circuit, plug the USB cable in to the Arduino, flash the source code and you should be ready to go.

HOW IT WORKS

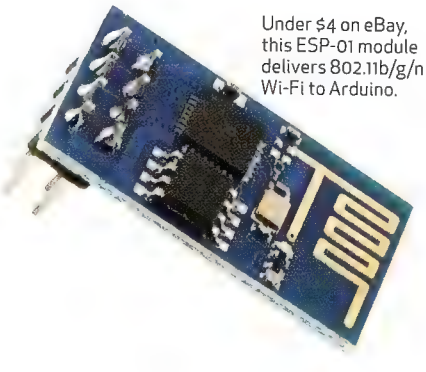
The Arduino Uno continually reads data from the DHT22 sensor and combines with the ESP-01 module to form a web server you can read from any web browser. While you must feed the source code with the Station ID (SSID) code and password for your network before you flash it to the Arduino board (you enter it at the top of the code), the ESP-01 uses dynamic host configuration protocol (DHCP) to



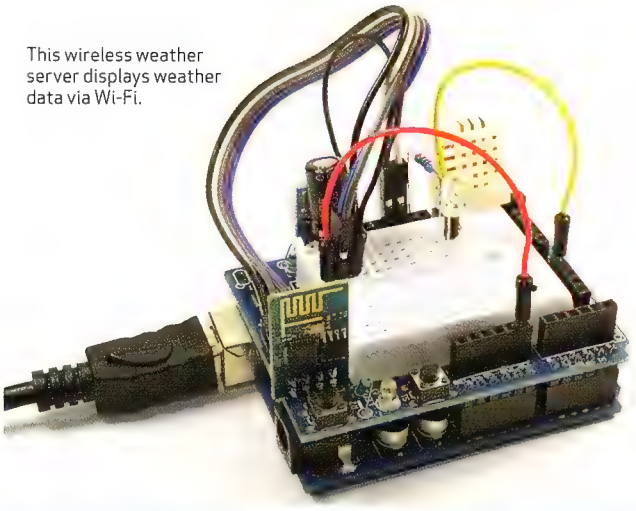
This tiny three-pin 3.3VDC regulator is needed to power the ESP-01 module.



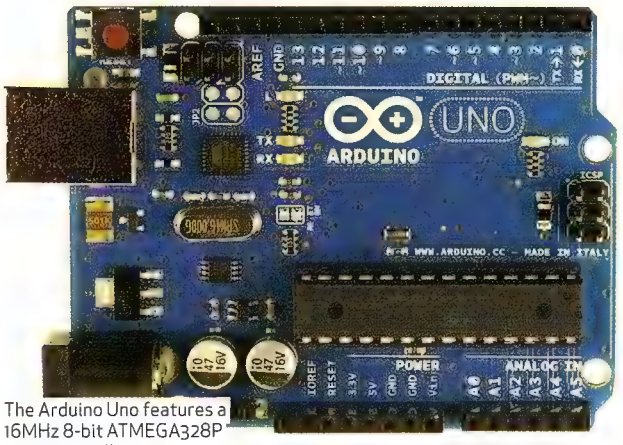
The DHT22 environment sensor plugs straight into the Arduino Uno board.



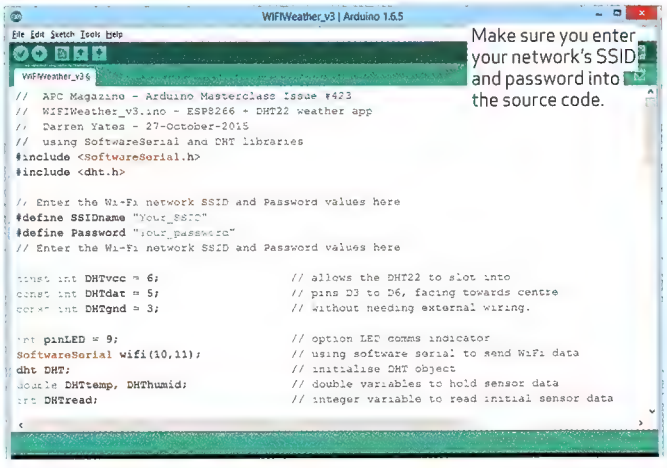
Under $4 on eBay, this ESP-01 module delivers 802.11b/g/n Wi-Fi to Arduino.



This wireless weather server displays weather data via Wi-Fi.



The Arduino Uno features a 16MHz 8-bit ATMEGA328P microcontroller.


WIFIWeather_v3 | Arduino 1.6.5
File Edit Sketch Tools Help
WIFIWeather_v3.ino
// APC Magazine - Arduino Masterclass Issue #423
// WIFIWeather_v3.ino - ESP8266 + DHT22 weather app
// Darren Yates - 27-October-2015
// using SoftwareSerial and DHT libraries
#include <SoftwareSerial.h>
#include <dht.h>
// Enter the Wi-Fi network SSID and Password values here
#define SSIDname "Your_SSID"
#define Password "your_password"
// Enter the Wi-Fi network SSID and Password values here
const int DHTvcc = 6; // allows the DHT22 to slot into
const int DHTdat = 5; // pins D3 to D6, facing towards centre
const int DHTgnd = 3; // without needing external wiring.
int pinLED = 9; // option LED comms indicator
SoftwareSerial wifi(10,11); // using software serial to send WiFi data
dht DHT; // initialise DHT object
double DHTtemp, DHThumid; // double variables to hold sensor data
int DHTread; // integer variable to read initial sensor data

Make sure you enter your network's SSID and password into the source code.

Type in the IP address and your server will give you the latest weather data.

automatically find an available IP address on your network. Once the module has established a network link, it just sits and waits for an incoming connection from another network client. While it waits, the Arduino reads the DHT22 sensor for temperature and humidity data every second.

The Arduino does its communicating over two serial ports – the first one is the standard hardware serial bus on pins D0 and D1 that connects up to your PC's USB port, which you monitor through the Arduino IDE's Serial Monitor window. The problem is, the Arduino only has one genuine serial port and we need two, so we make the second one via the SoftwareSerial library and pins D10 and D11. This second one is wired up to the ESP-01 to give us the data link between the Arduino and your wireless network.

READ IT VIA WEB BROWSER

Once you've built the circuit and flashed the source code, launch the Arduino IDE's serial monitor (magnifying glass icon, top right) and watch the output. It'll first give you the basic boot-up status information about various components, but you'll also find the IP address the server negotiates to use on your network. Type this IP address into the address bar of any web browser and, within a couple of seconds, you'll be greeted with the latest temperature and humidity data. The ESP-01 notes an incoming client, triggering the Arduino to transmit our HTML webpage data and act like a basic web server. In this case, the data includes the readings from the DHT22 sensor.

We've kept the LED indicator on pin D9 from last month – when it lights up, you'll know that a client is hitting the server. It's optional, though – if you don't have it, don't worry.

What's brilliant about the ESP-01 is that it hides all the complex wireless and wired signal handshaking to the Arduino board, meaning you can build your own web server with not much more than a handful of lines of code.

OTHER IDEAS

The use of the DHT22 sensor here really is just to give you a taste of what the ESP-01 is capable of. Combined with an Arduino, the ESP-01 gives you a tiny, low-power computing platform that's able to communicate with the internet and act as a simple, live web server for any low-speed application. Combine it with a Lithium-ion battery, charger circuit and small solar panel, for example, and you could make your own completely self-contained outdoor weather station that's live all day, every day. Throw in a MicroSD card reader that we've looked at previously and you can add up to 32GB of data storage to turn your project into a super-cheap data logger.

What's even more incredible is that it's now possible to code the ESP8266 chip in the ESP-01 module directly through the Arduino IDE and create your own tiny webserver the size of an SD card for less than $4.

Everyone is jumping on board the 'Internet of Things' (IoT) bandwagon these days and it's chips like the ESP8266 that is making it possible. The only things you need are a healthy inquisitive mind and some imagination.

Web server – minimum parts list

- Arduino Uno microcontroller board
- ESP-01 Wi-Fi module
- AMS1117 3.3VDC regulator module
- DHT22 environment sensor
- DIY prototype shield
- We purchased these parts from eBay and you should be able to find them for around $20 all-up.

Making your own GUI apps

Making Java apps with a graphical user interface means getting to know Layout Managers. Darren Yates explains by coding up a simple Home Loan Calculator app.

Over the last few months, we've had a bit of fun coding up a number of games in Java from basic WWII arcade flight simulators to codifying ancient semi-electronic handheld driving games. But chances are you'll also want, or be asked, to code up something a little more serious. Making your own apps with a graphical user interface (GUI) is a fundamental part of any coder's armoury, and in Java, it involves understanding the Layout Managers.

And to keep things practical, we've come up with a simple Home Loan Calculator to explain how it all works. You'll find the source code on our website at **apcmag.com/magstuff**. Unzip the file, load up the inner zip file straight into NetBeans IDE (File, Import Project, From ZIP) and run it. You can download the NetBeans IDE/Java development kit bundle for free from **www.oracle.com**.

BORDER, FLOW, GRID

One of the key factors in any GUI app is presentation – the user interface can often make or break an app, even if the app's functionality is first-class. To reduce the complexity, Java has its own Layout Managers to take care of GUI component layout automatically. You tell Java which type of layout you want, add those components to the frame or panel and Java does the rest. Well, sort of, as we'll see shortly.

Java has three types of layout manager – BorderLayout, FlowLayout and GridLayout.

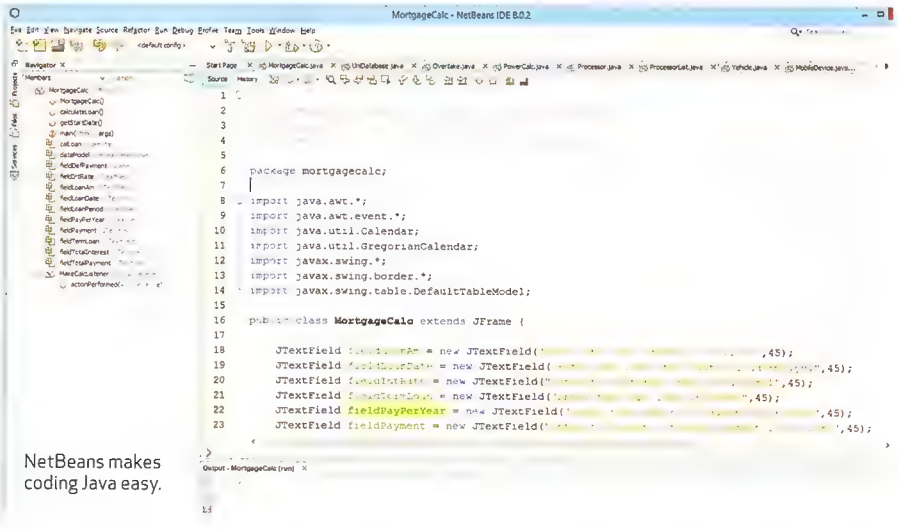
BorderLayout divides a frame or a panel into five compass-like regions – north, south, east, west and 'center'. When you add a component, you tell Java the region where that component should sit through constant values such as BorderLayout.CENTER or BorderLayout.NORTH. Of the five, the centre region is the only one that expands to fill any empty space within the frame or panel – the other four only take up as much space on the edges as required.

FlowLayout is a bit different. In fact, pretty much all it does is run your GUI components together from left to right across the panel or frame. Any component that does fit on a row flows on to a new row. What you can do with FlowLayout is decide whether to align GUI components to the left, centre or right of the panel or frame.

GridLayout is different again – here, you divide the frame or panel into an x-y matrix. But rather than tell each

WARNING

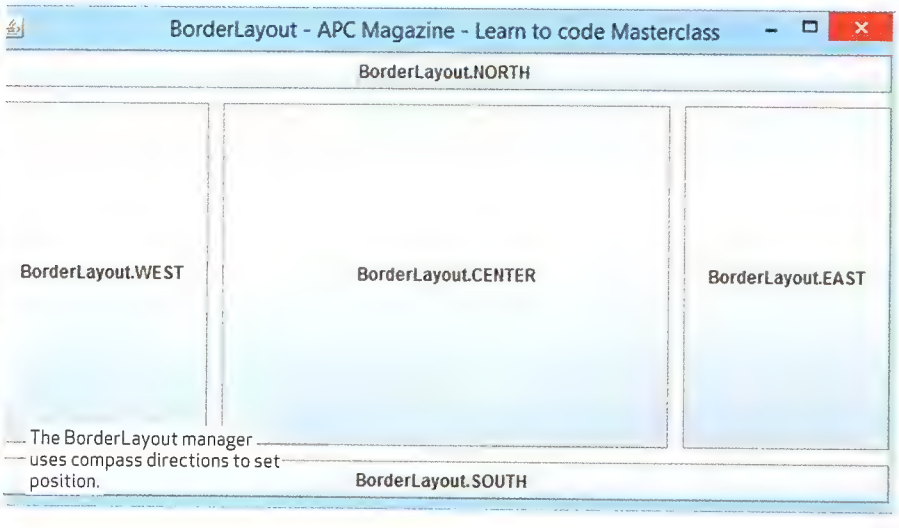
This story contains information about home loans but is provided for example only. Do not use this information as financial advice, but always seek out a financial advisor or your accountant before making any important financial decisions.



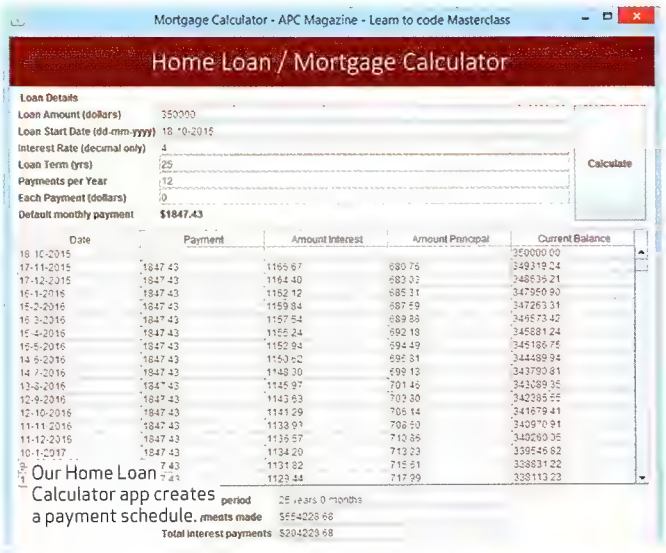
NetBeans makes coding Java easy.

```
public void getStartDate() {
    int day = Integer.parseInt(fieldLoanDate.getText().substring(0,2));
    int month = Integer.parseInt(fieldLoanDate.getText().substring(3,5))-1;
    int year = Integer.parseInt(fieldLoanDate.getText().substring(6,10));
    calLoan = new GregorianCalendar(year, month
}
```

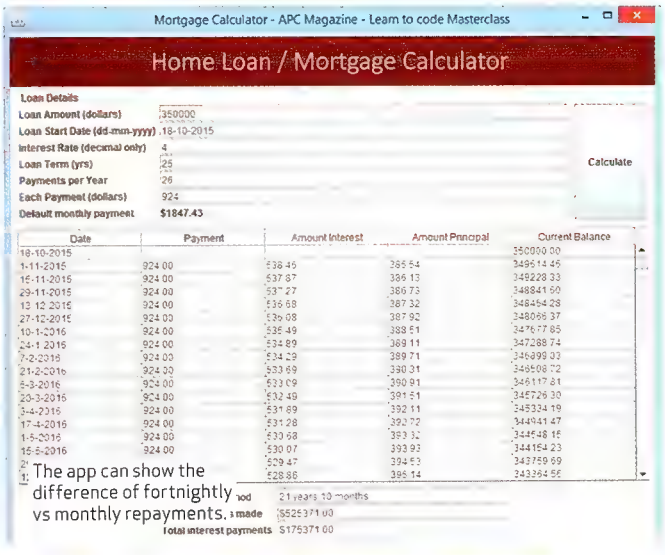
Java's Calendar class allows you to add and subtract to/from date objects.



The BorderLayout manager uses compass directions to set position.



Our Home Loan Calculator app creates a payment schedule.



The app can show the difference of fortnightly vs monthly repayments.

component which matrix cell it belongs to, Java just fills in your components from left to right, starting at top-left, until the row is full, and then it starts on the next.

These options might sound a bit primitive, but when combined with the ability to nest panels within panels, you can get some decent-looking GUIs happening. However, coding GUIs manually in Java can be time-consuming, which is why WYSIWYG-style GUI designers have appeared, like WindowBuilder (**eclipse.org/windowbuilder**) for Eclipse and NetBeans' own Swing GUI Builder (**netbeans.org/features/java/swing.html**).

But as a code-learning tool, there are two schools of thought; one, that GUI designers are great for newbies because they make it easier to create apps without learning too much code; and the other, that you learn better by doing things manually to start with and keeping the GUI tools for when you know what you're doing.

One factor worth considering is that not all auto GUI designers produce the neatest of code – and if you have to debug that code at some stage, your own code may be easier to follow than auto-generated code you may not have seen before. Another issue, relying on a particular GUI designer can make you IDE-dependent. If you change jobs and you need to change from NetBeans to Eclipse, being locked into NetBean's GUI designer might be a problem.

HOME LOAN CALCULATOR

With home prices going nuts over the last couple of years, we thought a quick home loan calculator would be a useful and practical way of bringing all of these concepts together. The idea is that you enter in the loan amount, loan start date, annual interest rate, loan term, the number of payments per year and an optional per payment amount.

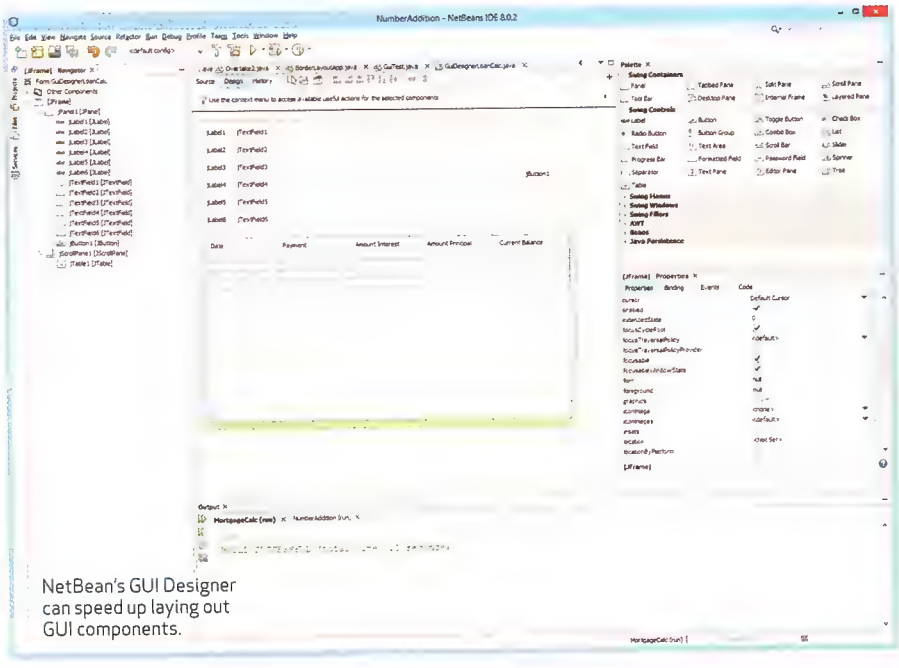
> "One of the key factors in any GUI app is presentation — the user interface can often make or break an app, even if the app's functionality is first-class."

Click the big Calculate button on the top-right and the app goes to work, churning through the numbers to create a payment schedule underneath. Finally, it calculates the actual payback period, total amount and total interest you've paid.

The new GUI component in this app we haven't looked at before is the JTable. JTable is Java's table container, but the actual data gets stored in a 'TableModel' interface object, the code for which looks something like this:

```
DefaultTableModel dataModel
= new DefaultTableModel();
JTable table = new
JTable(dataModel);
```

We create a DefaultTableModel object called 'dataModel' and it's attached to the JTable object called 'table'. The trick to remember is that you add data to the 'dataModel' TableModel object, not the 'table' JTable.



NetBean's GUI Designer can speed up laying out GUI components.

CALCULATING THE HOME LOAN

Getting back to the app, this gives us another chance to use Java's Math class and its Math.pow function. Home loans are calculated using a well-known amortisation formula shown here. They traditionally work on a basic roster of 12 monthly payments per year and either a 25- or 30-year loan term. Enter all the numbers into the formula and you'll get a base payment per month. For example, a $350,000 loan over a 25-year term at 4% per annum with 12 monthly payments per year works out to $1,847.43 per month.

Out of that payment, the first thing you pay is the interest and that's calculated simply by taking the loan amount and multiplying it by the interest rate divided by the number of payments per year. So on the first payment of our example, we're paying $1,166.67 in interest and the remaining $680.76 of that payment goes towards the loan amount, so that we now only owe $349,319.24. This process continues every payment until the loan amount is zero.

The app just mirrors this process, using a while-loop to run through each payment period, adding the repayment details to the table until the loan amount is zero.

PAYING OFF THE LOAN FASTER

Over the 25-year loan term, we'll end up paying $204,228.68 in interest. But one of the simplest ways to reduce that is by cutting the monthly repayment in half and making fortnightly rather than monthly repayments. Do that and the loan period drops to 21 years and 10 months and the total interest to $175,371, saving just under $29,000.

Now we're not financial advisors or accountants, so don't make any decisions based on this information. Always talk to your bank manager or financial advisor before making any important financial decisions. But mathematically speaking, what's happening here is that, by paying fortnightly, you're making 26 payments a year or the equivalent to 13 monthly payments instead of just 12. That extra payment lops off that bit extra from the loan and you pay it off that little bit sooner, saving you interest.

The point of the app is you can muck around with the numbers, press the Calculate button and recalculate the repayment schedule with new totals. The app is also designed to automatically choose the larger of either the default monthly payment or your chosen payment.

WHAT THE APP DOESN'T DO

Now as we said, this is only a quick, simple app and it doesn't take into account any fancy extras, such as fixed interest periods – that can be added but we'll leave it for you as an exercise. There's also no save option, but again, we've covered this before, so it's not difficult to do.

APP LAYOUT

The way we've laid the app out is through a series of nested JPanels. The base is the standard JFrame, which is given a standard FlowLayout, but to have the labels all appear neatly arranged, we've added a number of JPanels, each using a mix of GridLayout and BorderLayout managers.

Looking at the Loan Details section of the user interface, that whole section is a JPanel called 'panelInputs' that has a BorderLayout. The JLabels down the left-hand side exist in another JPanel called 'panelLabel', but here, we're using a GridLayout manager with the grid arranged in a seven-row matrix. The 'panelLabel' panel is then added to the 'panelInputs' panel with a set position of BorderLayout.WEST so that it's on the far-left side of the panel.

We then create another JPanel called 'panelField' with the same seven-row GridLayout and add in the JTextFields the user enters the data into. This is also added to the panelInputs panel but set to BorderLayout.CENTER. Finally, we add the Calculate JButton to panelInputs and point it to BorderLayout.EAST, so that it's on the panel's far-right hand edge.

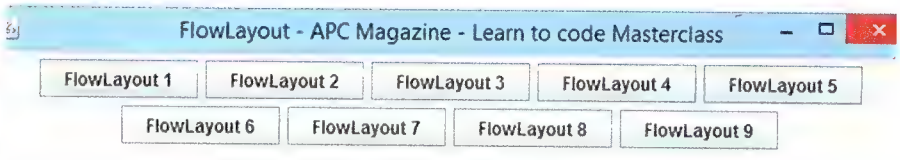
Next, we create the JTable. Using the 'addColumn' method, we add the column headers to the table. We then set what's called the 'ViewPort', or its

Amortisation Formula

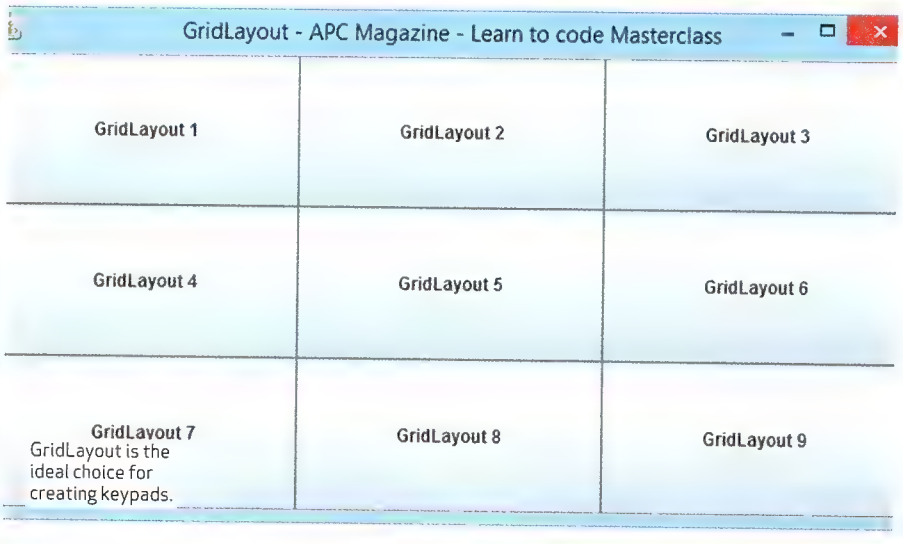
$$A = P\,\frac{i(1+i)^n}{(1+i)^n - 1}$$

A = payment amount per period
i = interest rate per payment period
P = principal (home loan amount)
n = total number of payments

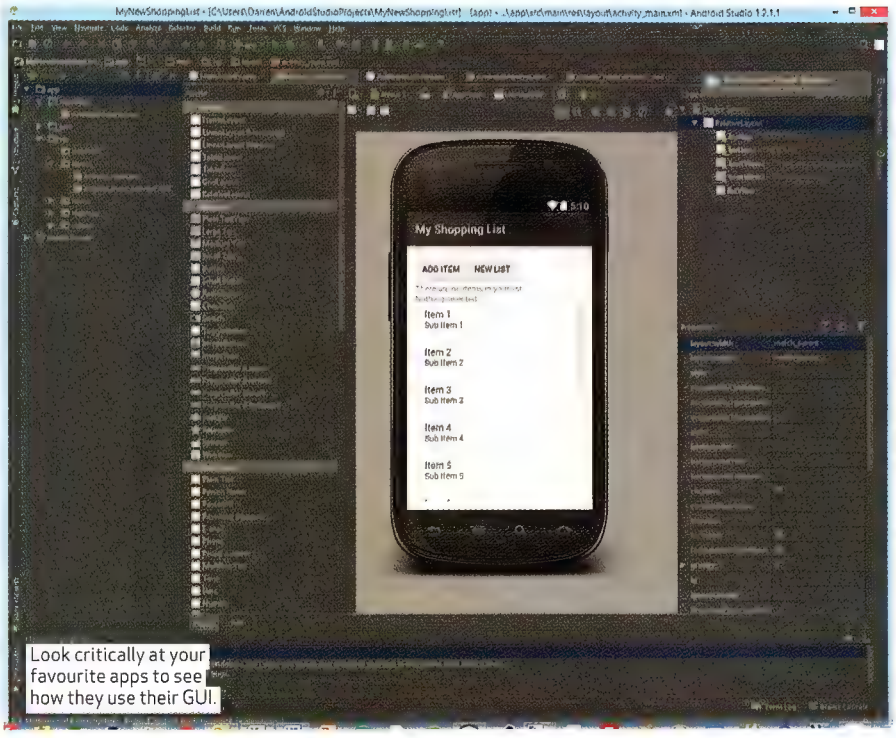
This is the age-old formula used in our Home Loan Calculator app.



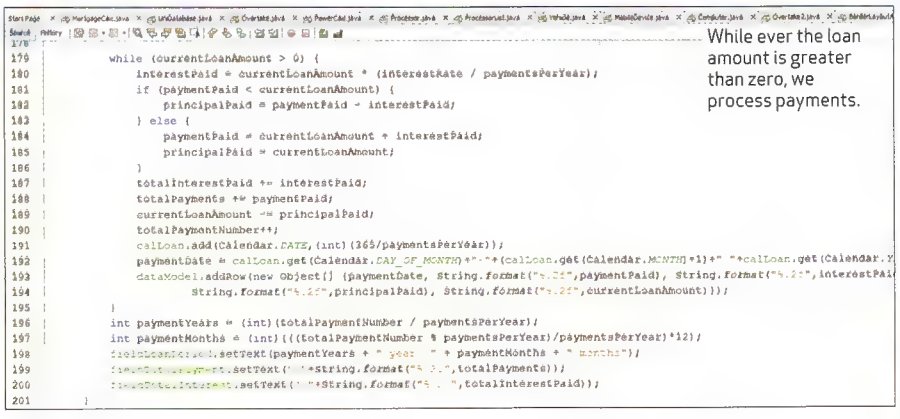
FlowLayout is the simplest of Java's Layout Managers.



GridLayout is the ideal choice for creating keypads.



Look critically at your favourite apps to see how they use their GUI.



```
        while (currentLoanAmount > 0) {
            interestPaid = currentLoanAmount * (interestRate / paymentsPerYear);
            if (paymentPaid < currentLoanAmount) {
                principalPaid = paymentPaid - interestPaid;
            } else {
                paymentPaid = currentLoanAmount + interestPaid;
                principalPaid = currentLoanAmount;
            }
            totalInterestPaid += interestPaid;
            totalPayments += paymentPaid;
            currentLoanAmount -= principalPaid;
            totalPaymentNumber++;
            calLoan.add(Calendar.DATE,(int)(365/paymentsPerYear));
            paymentDate = calLoan.get(Calendar.DAY_OF_MONTH)+"-"+(calLoan.get(Calendar.MONTH)+1)+"-"+calLoan.get(Calendar.Y
            dataModel.addRow(new Object[] {paymentDate, String.format("%.2f",paymentPaid), String.format("%.2f",interestPai
                    String.format("%.2f",principalPaid), String.format("%.2f",currentLoanAmount)});
        }
        int paymentYears = (int)(totalPaymentNumber / paymentsPerYear);
        int paymentMonths = (int)(((totalPaymentNumber % paymentsPerYear)/paymentsPerYear)*12);
        fieldLoanTerm.setText(paymentYears + " year  " + paymentMonths + " months");
        fieldTotalPayment.setText("  "+String.format("%.2f",totalPayments));
        fieldTotalInterest.setText("  "+String.format("%.2f",totalInterestPaid));
    }
```

While ever the loan amount is greater than zero, we process payments.

viewable screen size. The last thing we do here is attach the table to a JScrollPane called 'scrollpane' – what this does is that, when the number of table rows exceeds the viewport size, Java automatically adds vertical scrollbars on the table's right edge to allow you to see the hidden rows.

To finish off the GUI, we create another JPanel called 'panelTotals', which houses two more JPanels for labels and textfields displaying the totals at the bottom of the screen.

CLICK AND CLEAR

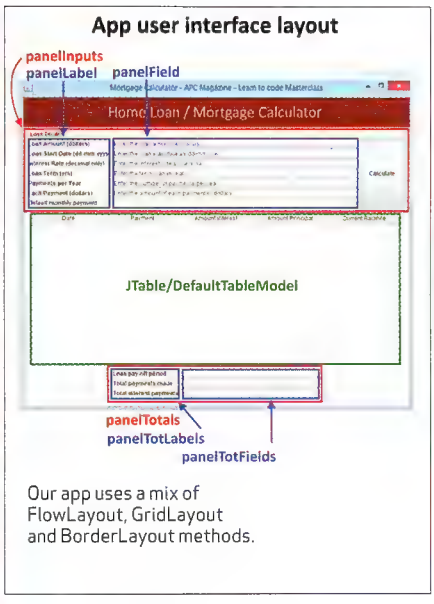
The JTextFields at the top have in-line instructions, but click inside them and the instructions disappear. This is done by attaching an addMouseListener to each JTextField, so that whenever the textfield is clicked, any text is removed by simply setting the setText() parameter to empty.

CALCULATE DATES

To get calculations started, we attach a custom ActionListener to the Calculate JButton called 'MakeCalcListener' and as soon as it's clicked, the getStartDate() method is launched. One of the things Java standard-edition (SE) doesn't do as well as it could is work with dates. It's not bad, but it could be better.

We want to create a payment schedule with dates of each payment, beginning with the loan start date and calculating them right through the loan term. To do that, we parse the loan start date the user provides and create a Calendar object of type 'GregorianCalendar', which is the standard calendar most of the world uses.

What's important about the Calendar class is that it makes it very easy to add days to a date and get the new date without having to manually calculate ends of months or leap years. The 'getStartDate' method turns the user supplied start date into a Calendar object. It's then used in the statement:



Our app uses a mix of FlowLayout, GridLayout and BorderLayout methods.

```
calLoan.add(Calendar.
DATE,(int)(365/
paymentsPerYear));
```

Here, we take the current date value of the 'calLoan' Calendar object and add in the number of days between each payment. The Calendar object allows you to obtain the day, month and year as separate parameters and use them as you will. The only trick is that month values start from zero, so January is 0, February is 1 and so on. Calendar also can't subtract one date from another, which would have been nice.

MAKE YOUR OWN GUI APPS

Probably the key thing to take away from this is that there's no perfect way to make a GUI – really, it's whatever works. Developing a decent GUI is an art form that involves combining the functional with the aesthetic. One of the best ways to learn is by looking over your favourite apps with a critical eye – look at how the GUI components are arranged, how they're grouped and where they're located. Ask yourself if there's a better way that this could have been done.

One of the best forms of feedback is from users you hope will use your app. If they can work out how to use your GUI with minimal assistance, chances are you're heading in the right direction; for in the end, that's what apps are all about. You can have the best, most functionally brilliant app in the world, but if the thing is too hard to drive or looks like the dog's breakfast, it won't be as successful as it could otherwise be.

I wouldn't call myself an expert, but GUI design is a highly valuable skill, as critical to successful software implementation as any class, function or method. It's something every software engineer should appreciate.

Looking down the scopes to get the perfect photo? No, just shooting people.

Zombies enjoys its maddest, fattest entry to date.

The excellent Free Run mode is part time trial, part tutorial.

FROM $79.99 | PC, XBOX360, X1, PS3, PS4 | WWW.CALLOFDUTY.COM

Call of Duty: Black Ops III

Shooting juggernaut continues to be top of the ops.

Black Ops III is, well, bonkers. This is a game in which the ability to make soldiers vomit themselves to death rubs shoulders with running through a 1930s noir-style zombie adventure as Jeff Goldblum.

When it comes to the multiplayer, there are two major tweaks to the formula. *Advanced Warfare* introduced double jumps; *Black Ops III* pilfers them and whacks in the ability to wall-run. It's a critical part of this *CoD*'s charm, as running becomes as vital as gunning in every single game mode. It's also just as enjoyable, as you start to almost fly through maps.

Black Ops III's other major renovation to its colossally popular online arm is ditching genro-soldiers for specialists. There are nine classes and each has two abilities to pick between.

Even with these tweaks, online multiplayer still feels like coming home at Christmas. There's the reassuringly twitchy feel to firing guns, many a spot perfect for setting up camp, and the criminally addictive drip feed of toys. The changes fit in seamlessly – it's as if you've always been able to shoot a gun that fires electricity while jogging along the side of a house.

But, while the sense of control over your character is the best it's ever been in *CoD*, the level design has trouble keeping up. Plenty of areas are barred-off behind invisible walls – for example, the slanted church roof in Infected. They're easily reached, with no apparent reason for being inaccessible. It's monumentally frustrating that movement allows you a greater level of exploration and then the game artificially locks off certain areas.

But while the competitive multiplayer changes are evolution, not revolution, the campaign's overhaul to focus on co-op in every facet of its design is much bolder. Key to this new approach is the Safehouse, a playable lobby area that gives you time to choose your loadout, unlock new Cyber Cores (your campaign super moves) and pick a mission. But the Netflix-inspired episode select, with every level unlocked from the start, isn't a huge game-changer and just gives you a way to keep up with friends.

Take the mission Hypocentre, which is cannily designed for teams, but vein-poppingly infuriating as a solo player. Mid-mission, you're tasked with taking on waves of enemies while shooting out a power core and placing explosives. With a team, two take crowd control, one handles the power and the other runs in to sort out the explosives. Alone, you die. Lots.

Play it in co-op and it's the most fascinating campaign *CoD*'s boasted in some time. Levels also benefit from extended lengths, with the runtime around the 12-hour mark.

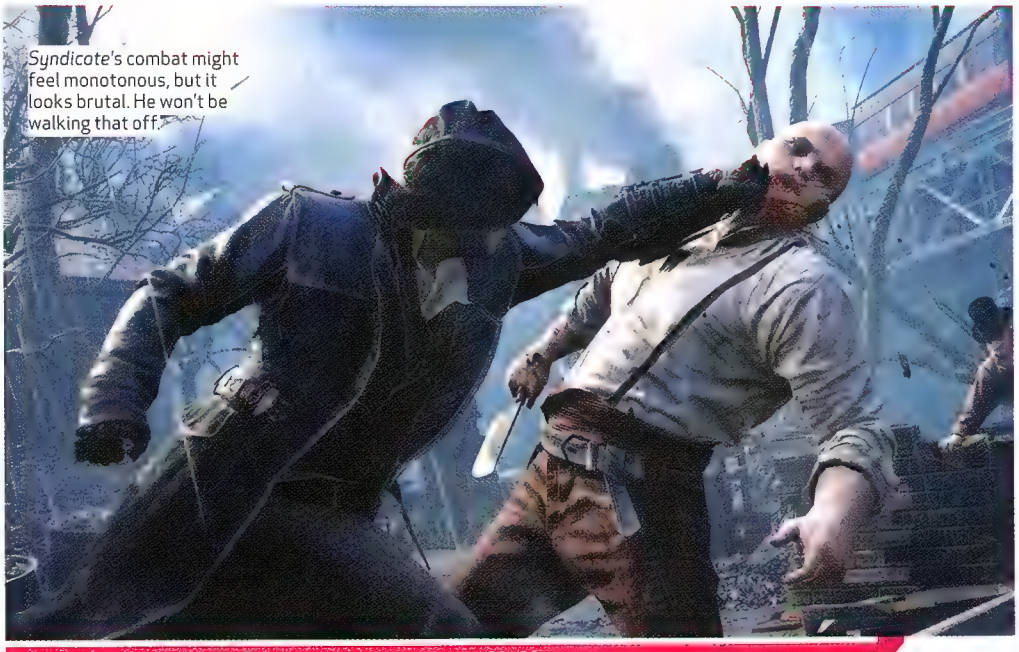
It's more compelling than the typical shock-and-bore *CoD* campaigns, but the overall plot is an incoherent blur of moments that don't quite make a satisfying whole.

The campaign's only part of the picture, though. This year's entry has plenty of other modes to keep you hooked. There's the returning Zombies mode, with its brutal difficulty and a setup that maintains the high standard of weirdness. There's also a short, *Mirror's Edge*-lite Free Run time trial mode, and one other gametype that only becomes accessible if you finish every campaign level, which I strongly recommend you do, pronto. ■ **Ben Tyrer**

Verdict

A return to form despite some questionable multiplayer level design and an absurd story.

★★★★☆



Syndicate's combat might feel monotonous, but it looks brutal. He won't be walking that off.

FROM $89.99 | XO, PS4, PC| ASSASSINSCREED.UBI.COM/

Assassin's Creed Syndicate

Not top of the tower, but too cool to care.

Let's not mince words here: *Assassin's Creed Unity* was difficult. Difficult for the fans; difficult for Ubisoft; difficult for everyone. We wanted *Assassin's Creed Syndicate* to return, top hat in hand and heart in mouth, to ask us to reconsider. We wanted an apology, of sorts. Well, guess what? It doesn't give us one – and that's okay.

There's nothing cringing or self-effacing about *Syndicate*. It goes blades-deep and hell for leather, launching twin torpedoes Jacob and Evie into an obscenely colourful world. Carriage chaos and gang wars are par for the course, as are some of the most macabre assassinations we've ever seen. The main villain has a handlebar moustache, for Pete's sake. It's ridiculous, and brilliantly so. Sadly, this don't-give-a-damn attitude results in more of the sloppiness that *Creed* has previously displayed – but the game's unabashed air is undeniably exhilarating.

So, too, is traversing sun- and rain-soaked Victorian London, Cockney chatter floating up to the rooftops on which you're so carefully perched. Reaching the dizzying heights of the city is a breeze thanks to the up and down freerun buttons introduced in *Unity*, and *Syndicate* has thrown a rope launcher into the bargain – it'll whizz you across London's wide streets with a flick of your wrist.

Syndicate's story and cast are engaging, including an affable Alexander Graham Bell and a stylish, tea-drinking Templar villain. Impeccably written siblings Jacob and Evie might be twins, but they have distinct playstyles and personalities. Jacob gees up horses by cooing, "Who's a good horse?" Evie prefers a guttural scream and a lash of the whip.

If only hand-to-hand combat was as diverse. Mashing the attack button is a repetitive slog, seemingly disconnected from your inputs and lasting an age. Tedium swiftly morphs into frustration once you escape conflict and attempt to hurriedly loot a crate or hijack a carriage. Hitting the multi-purpose button in *Syndicate* is like playing Russian roulette; if your luck isn't in, it's all over in those few seconds it takes you to accidentally pick up a corpse. Gutted – literally.

I manage six gloriously naive hours in *Syndicate*'s London before I manage to find glitches. Suddenly, I'm spotting the cracks in the code. Graphical hiccups are amusing, unresponsive button prompts are less so. One or two side-missions become farcical as I try in vain to tackle a target that's suddenly gone all coy.

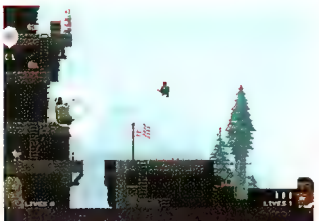
Like a carriage gone rogue, the franchise keeps barrelling on and on, with little regard for the damage it does to itself. It's alarming to watch but, in *Syndicate* at least, electrifying to play. Fast-paced, more than a little reckless and fiercely beautiful, *Assassin's Creed*'s long-awaited visit to London is, in a word, unapologetic.

■ Jen Simpkins

Verdict

Fans of the series will appreciate it for what it is, but Syndicate doesn't repair all of Unity's damage.

★★★½☆



Broforce

Get mission -> kill bad guys -> rescue good guys -> kill big bad guy -> escape on helicopter into sunset.

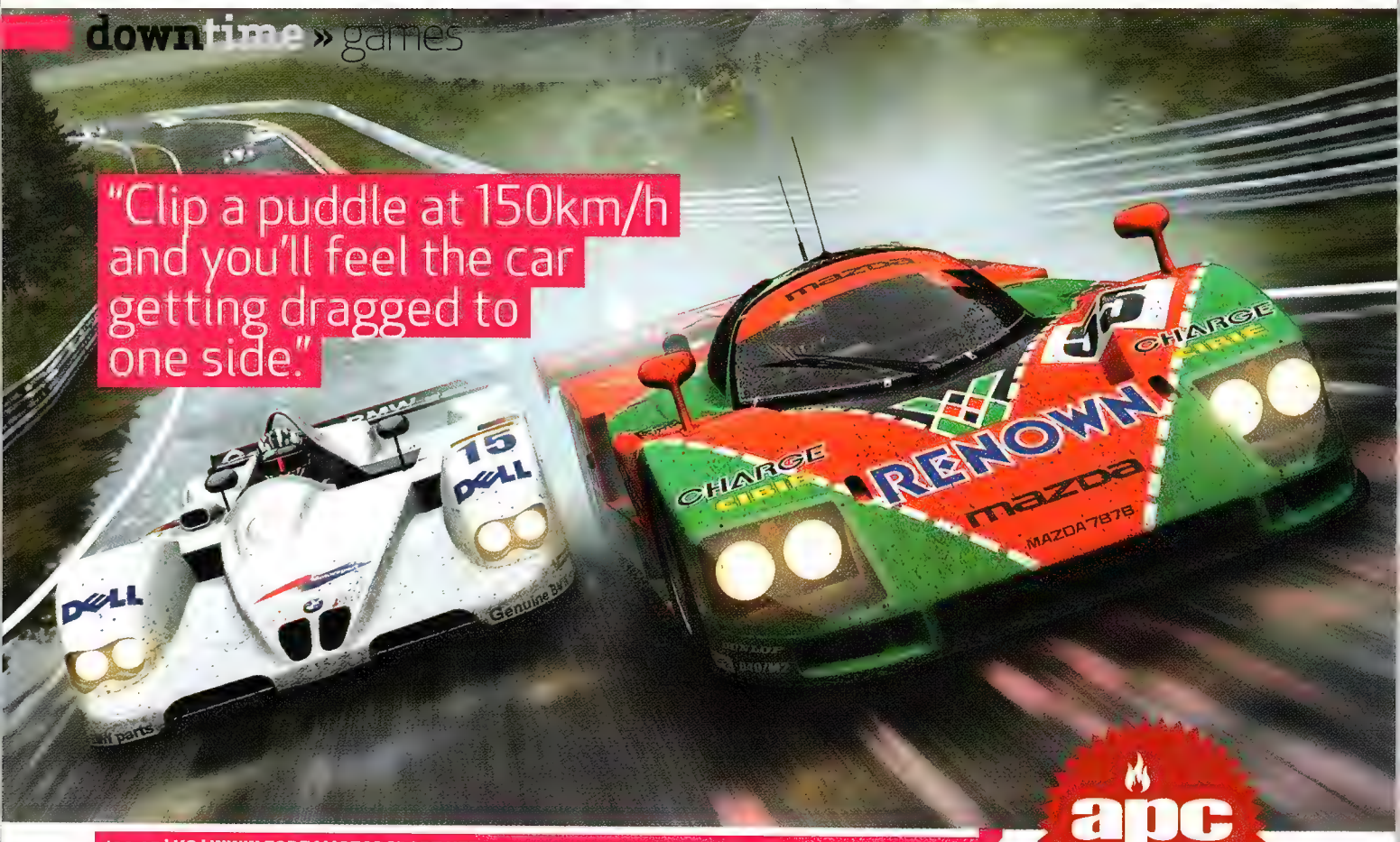
US$14.95 | PC | WWW.BROFORCEGAME.COM

The archetypal action movie plot is so mechanical that developer Free Lives has turned it into an actual game mechanic. It's how every single level of *Broforce*'s technically endless campaign plays out. It may take the form of the run 'n' gun genre — all pixels, enemy screams and one-shot-one-death twitchery — but you'll draw more of your understanding from the films those games were invoking in the first place.

That's most obvious in the characters, every one of which is pacey, can climb any surface infinitely, and comes with primary, secondary and melee weapons. There's no choice as to who you play: you're randomly assigned a Bro at the start of a stage. Rescuing a caged PoW wins you an extra life but randomises you again. It's a lovely system, making you weigh the benefits of a good character against staying alive longer but getting a crap one. Everyone wants to be Leon, who can have tiny Natalie Portman snipe swathes of enemies, but no one bar no one wants to be McGyver, who weedily throws big turkeys with TNT stuffing. The more PoWs you rescue, the more Bros you're able to turn into.

It's certainly a spectacle – with the right four characters, the entire screen can disappear in seconds – but actually playing becomes a sterner test. It's incredibly easy to lose track of your character, so you don't notice you're collapsing a bridge on your friends' heads, ruining the game for everyone.

■ Joe Skrebels



$99.95 | XO | WWW.FORZAMOTORSPORT.NET

apc HOT PRODUCT

Forza Motorsport 6

A petrol-head's paradise.

Remember, back in 2013, when *Forza Motorsport 5* came out? Cripes, it was good, wasn't it? Except that there weren't that many cars to begin with. And the track roster was about half as full as it should've been. And there were all those microtransactions. Well, that's old *Forza*, because new *Forza* comes scrreeeeeaaming round the hairpin, and it's not only doing things right, it's doing the right thing.

Out go the much-loathed microtransactions, and in comes fun, supercharged by a tank-full of brand-new ideas to make it feel fresh. It's bursting with personality, partly thanks to the return of May and Hammond (though Jeremy 'Hot Dinner' Clarkson is conspicuously M.I.A.) and a few other guests who introduce new events and tracks, offsetting an otherwise hilariously po-faced narrator. Most importantly, though, the cars feel the best they ever have, a touch lighter but more robust and happy to be flung into corners. While *Forza 6* is definitely more on the simulation side of the racing divide, leaving the more arcade-y fare to Forza Horizon, there's more forgiveness here than previous iterations.

Don't think that makes things any easier, though. Whereas there were once 15 Drivatars cruising round the track with you, that's been upped to 23, and they're now far more vicious (although they occasionally still show that they're as dumb as a box of hammers, getting stuck on a barrier and not being able to figure out how to reverse off it). Their aggression – side swiping, risky overtakes and spiteful braking – can be numbed from within the options, but you'd be cheating yourself out of a bloody good challenge if you did so.

Mod cards, either won at each new driver level, or bought using in-game credits, affect your car's specs and handling, or muck around with your camera settings. You might, say, get a card that lops 10% off your braking but boosts your cash-earning potential by 10% in exchange, or another that forces you to drive in cockpit view and with the racing line off but awards a hefty 20% extra credit. Some are a one-turn deal, others last forever.

As divisive as that may be, the night-time tracks and wet weather are both glorious and brutal. Not every course gets this treatment, but the ones that do force you to think differently to make it round in one piece. Clip a puddle at 100km/h-plus, and you'll feel the car getting dragged to one side, and the more skittish cars take a lot of wrestling to regain control. It's as wonderful as it is torturous, and tackling the mighty Nordschleife, in the dark, is a similarly terrifying prospect.

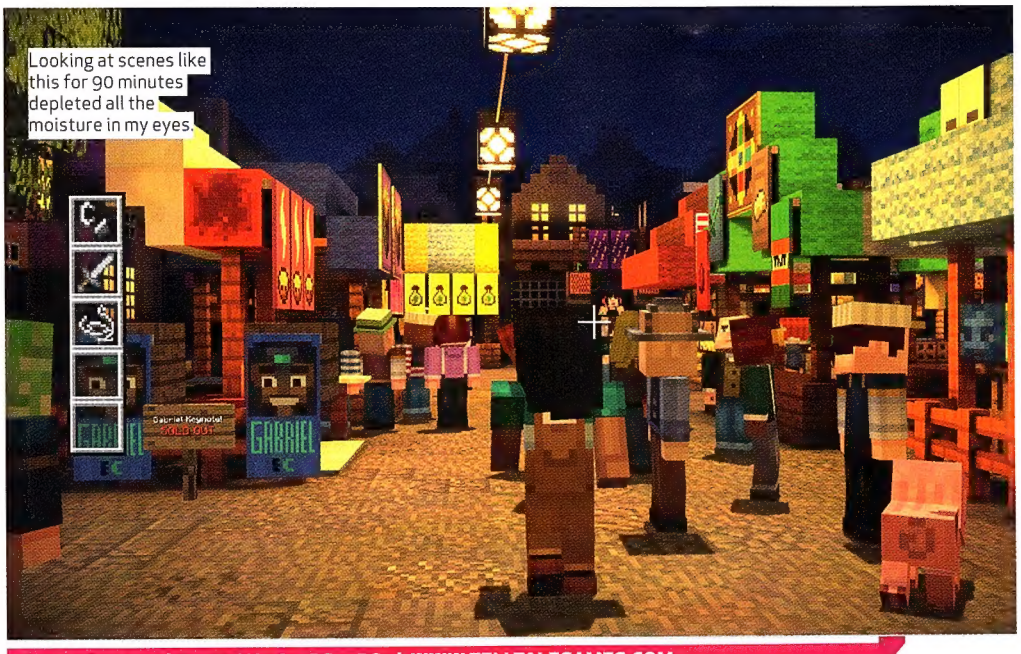
However, there are still some misfires. Every race demands a podium finish, otherwise you'll have to restart to progress, robbing a racing series of texture – it'd feel more natural to have a poor race and then make it up on the next. Lighting effects are also baked in like *Forza 5*, and the rain (as good as it is) is always constant – something that *Project Cars* manages to get right. Still, something had to give to hit that 1080p @ 60fps target, and this was it. A small price to pay for the best *Forza* you've played this generation.

Paul Taylor

Verdict

Throw your copy of *Forza 5* in the bin – this new entry improves on the formula in every way.

★★★★½



FROM US$24.95 | X1, XBOX 360, PS4, PS3 | WWW.TELLTALEGAMES.COM

Minecraft: Story Mode

Might delight diehard fans, but it's far from Telltale's best.

***Minecraft: Story Mode* is Telltale's story adventure spin-off of *Minecraft*, and it works like the dev's other games — timed dialogue options, binary decisions, awkward walking, and mashing 'Q' to do things, which hasn't been novel since the first season of *The Walking Dead*. It's the writing, characters and art that have made Telltale's games great in recent years, and they keep delivering. Except for this one.**

The voice acting is good and there's a cute pig, but the dialogue isn't especially funny, and the world is about as developed as *Minecraft*'s world. Our heroes are supposed to be young people going on a *Goonies*-like adventure, but you're never told anything about their lifestyle or society other than there's a yearly building competition? That's all these characters seem to know about: the legendary heroes who defeated the Ender Dragon and the big building competition.

In this bland world, the stakes seem to be that a *Minecraft* server is in peril. Our heroes, who have no responsibilities and nothing to lose, must leave behind a crappy tree house to save it.

As usual, there's a little bit of walking around, but it's awkward and uses invisible walls to contain you. And, also as expected, the action isn't very fun. It's just a case of walk towards a monster, swing your sword, or press WASD at the right time to dodge things. I wanted to be impressed by the world and camera direction and funny quips, which is the stuff that makes *Tales from the Borderlands*' action interesting, but I just didn't find any of the characters funny, or any of the scenes exciting. Instead, it's ugly. *Minecraft* is beautiful because it's this vast, primitive blockscape full of potential, where distant mountains are an adventure and a sweet little valley is a cute place for a cabin. *Story Mode* zooms in on it, filling the frame with ugly pixel mosaics and blurry details. It's mostly close-ups on characters talking out of their hideous mouths, and they're not cute.

This is also the most technically flawed Telltale game I've played. It crashed four times, losing my progress, and had a few graphical glitches. But even ignoring that, I'm starting to wonder if it just wasn't a good idea to make a Minecraft adventure game. The world feels freshly made and without character, and there's no good way for it to reflect its source material's values. When it winks at building and crafting, I just feel constrained, like I've been strapped to a camera dolly. I might be somewhere magical, but I can't turn my head to look.

Story Mode can get better, certainly, but Telltale usually impresses with its first episode and this was a drag. I'm in the minority on this, I'm sure, as *Minecraft* fans may well be delighted by more *Minecraft*, and Telltale fans get more Telltale. The game has building montages and a headstrong hero, goofs about chickens and a choice of who to save — *Minecraft* and Telltale, mashed together. But I found the best parts of each were lost in transmogrification.

■ Tyler Wilde

Verdict

A disappointing mismatch. It can get better, but so far *Minecraft: Story Mode* is just boring and ugly.

★★½☆☆

Destiny: The Taken King

A meaty, satisfying FPS experience, but it's a shame we had to wait.

FROM $79.95 | PS3, PS4, XBOX 360, XBOX ONE | WWW.DESTINYTHEGAME.COM

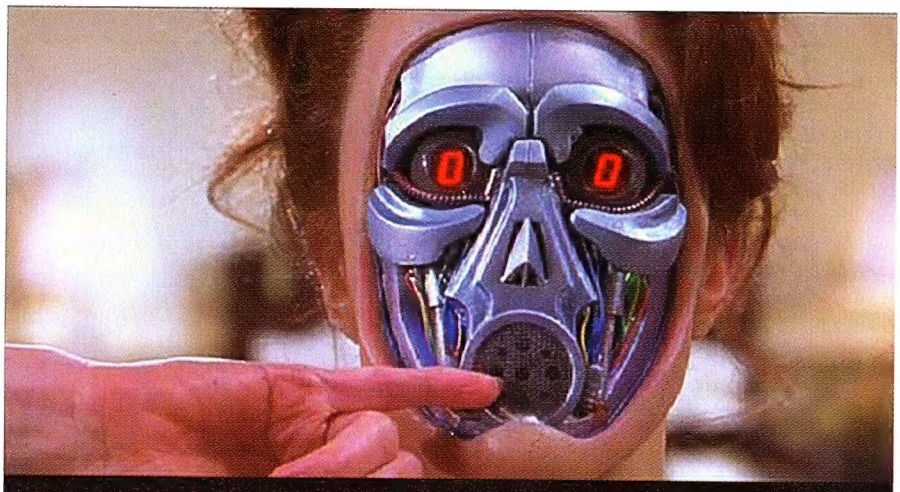
The cynical take on this premium *Destiny* expansion is that it introduces elements that should have been in the game all along: the campaign is much improved (and much bigger) now, with some much-needed depth applied to a template that previously relied too heavily on rote running and gunning. The optimistic take is that if you haven't bought *Destiny*, this is just about the most satisfying console shooter on the market. While the hallmarks of Bungie's original offering are still its strongest assets — beautifully fluid cooperative gunplay, stunning environments — there's just a lot more of it here, and progression isn't hamstrung by a stingy random-number generator. Indeed, acquiring premium weapons and gear is a lot more frequent and rewarding than it used to be, and due to the bulk of options, ceaseless repetition of the same raids and strikes doesn't feel as crucial as it used to be. While *The Taken King* is undeniably great, it does raise questions about the future of online-focused gaming on consoles. Is buying day one a good idea anymore? With *Taken King* selling for the same price as the launch game, early adopters might wonder whether they should have waited a year. If you're already acclimatized to this modern monetisation scheme, though, *The Taken King* is hard to pass up if you're craving a sci-fi shooter. ■ Shaun Prescott

'Drone slayer' in the clear

Judge dismisses accusation of criminal mischief.

William Merideth, a Kentucky man who was taken to court after he shot down a drone hovering over his house, has been cleared of all charges. According to three witnesses, the drone was seen below the tree line, which was deemed a "violation of privacy".

For Judge Rebecca Ward, this gave Merideth "a right to shoot". However, the drone's pilot, David Boggs – who has footage showing that the drone was above 200 feet high when it was shot down – complained that the judge did not even look at the video, instead relying solely on witness statements. Boggs has said that he intends to continue the fight.



High-tech lovers

INTERNATIONAL CONFERENCE ON ROBOT COMPANIONSHIP SHUT DOWN BY MALAYSIAN POLICE.

Police in Malaysia have banned the Second International Congress on Love and Sex with Robots from taking place in the country. The conference was aimed at exploring questions about the field of human/robot interaction — an important topic for the not-so-distant future. David Levy, the creator of the event, suggests that relations with robots (ranging from friendships to sexual companionship) could be considered normal by 2050. Professor Adrian Cheok, specialising in robot hardware, stresses that "the ethics and philosophy" of the idea must be researched and openly discussed to address society's fears and issues.

Despite the setback in Malaysia, the group is determined to reschedule the conference for 2016.

Rumblr fools thousands

THE FIGHTING APP MARKETING STUNT.

We're all very familiar with the concept of websites or apps trying to bring people together. While some services have a more romantic idea in mind for their users, Rumblr wanted them to punch each other in the face. Claiming to be "like Tinder" but for fighting dates, the app got users to sign in and then paired them up with a fake contender. More than 300,000 people were fooled into signing up for the beta before the app developers admitted that it was a hoax. Considering the legal ramifications that could have spawned from any injuries caused by Rumblr scheduled fights, the fact that this app was a fake is reassuring... sort of.

Finland leading the way

THREE HOT NEW TONGUE-IN-CHEEK EMOJIS.

Finland has become the first nation in the world to publish its own country-specific emojis. Featuring a headbanger rocking out a double set of devil horns, a Nokia 3310 (named the Unbreakable) and two naked sauna-goers, ThisisFINLAND's 2015 Christmas calendar is set to contain 30 quintessentially Finnish stickers. "We have been anything but serious when creating these emojis," the Director for Public Diplomacy at the Ministry for Foreign Affairs Petra Theman claims. This probably means that, in the months to come, other nations will follow suit. Undoubtedly, we will soon see Aussies mowing lawns, tending to barbeques, getting sunburnt and riding kangaroos to work. ■

NEW ARRIVALS

Pioneer of Innovative Technology

DreamMobile Smart Phone H55
From $299
RRP Inc-GST

AMD Quad Core 1.3GHz
5.5" IPS Display
4G Network

- 5.5" HD (1280x770) IPS Capacitive Touch Display
- ARM Quad Core 1.3GHz
- 8/16GB ROM; 1/2GB RAM; Up to 128GB Internal Storage
- 5.0M Front camera (video support); 8.0/13.0M AF camera
- 4G Network, GPS/WiFi, FM/Bluetooth, G-sensor
- Dimensions 152.8mm(H) x 77.9mm(W) x 7.0mm(H)

DreamBook M12 Windows 2-in-1 Tablet
From $399
RRP Inc-GST

11.6" Multi-Touch
Up to 128GB SSD
Windows 10 & Office 365

- Intel BayTrail-T CR Quad Core 1.8GHz (Z3735G) Processor
- 2GB DDR3L 1600MHz Memory
- Up to 64GB SSD Storage (eMMC)
- 11.6" TN (1366x768) 5-Point Multi-Touch Screen
- 1080P HD Playback; Micro-SD; Micro USB; Micro HDMI; 2.0MP Front/5.0MP Back camera; 3G (optional)

DreamBook Style W54U
From $559
RRP Inc-GST

14" Multi-Touch
1x mSATA 1x SATA
Windows 10

- Intel® Pentium® processor
- Up to 16GB DDR3L 1600MHz Memory
- Intel® HD Graphics
- 14" HD (1366x768; 16:9) Crystal Bright Screen
- 9-in-1 Card Reader; 802.11b/g/n WiFi; Bluetooth 4.0; 1.0MP HD Camera; HDMI; USB 3.0

DreamBook Style W33
From $799
RRP Inc-GST

13.3" IPS Full HD Screen
1x PCIe SSD 1x SATA
Windows 10

- 5th Generation Intel® Processor
- Up to 16GB DDR3L 1600MHz Memory
- Intel® HD Graphics 5500
- 13.3" IPS Full HD (1920x1080; 16:9) Crystal Bright Screen
- 6-in-1 Card Reader; 802.11b/g/n WiFi; Bluetooth 4.0; 2.0MP HD Camera; HDMI; USB 3.0

DreamBook Power N17
From $1,449
RRP Inc-GST

17.3" LED Full HD Screen
1x PCIe SSD 2x SATA
Windows 10

- 6th Generation Intel® Processor
- Up to 16GB DDR3L 1600MHz Memory
- NVIDIA® GeForce® GTX 960M 2GB GDDR5
- 17.3" LED Full HD (1920x1080; 16:9) Crystal Bright Screen
- 6-in-1 Push Push Card Reader; Fingerprint Reader; WiFi; Bluetooth 4.0; 2.0MP HD Camera; HDMI; USB 3.0

DreamBook Power P77
From $2,099
RRP Inc-GST

17.3" Full HD Screen
2x PCIe SSD 2x SATA
Windows 10

- 6th Generation Intel® Processor
- Up to 64GB DDR4 2133MHz Memory
- NVIDIA® GeForce® GTX 970M 6GB / 980M 8GB GDDR5
- 17.3" Full HD (1920x1080; 16:9) Crystal Bright Screen
- 6-in-1 Card Reader; Fingerprint Reader; WiFi; Bluetooth 4.0; 2.0MP Full HD Camera; HDMI; USB 3.0

DreamBook Power P87 SLI
From $2,999
RRP Inc-GST

17.3" LED Full HD Screen
2x PCIe SSD 2x SATA w/Raid
Windows 10

- 6th Generation Intel® Processor
- Up to 64GB DDR4 2133MHz Memory
- 2x NVIDIA® GeForce® GTX 970M 6GB SLI / 980M 8GB SLI
- 17.3" Full HD (1920x1080; 16:9) Crystal Bright Screen
- 6-in-1 Card Reader; Fingerprint Reader; WiFi; Bluetooth 4.0; 2.0MP Full HD Camera; Thunderbolt; eSATA; HDMI; USB 3.0

DreamMicro Power Server 1U D51PS
From $2,399
RRP Inc-GST

Intel® Xeon® E5 v3
Up to 32GB Memory
4x Hot Swap Drives

- Intel® Xeon® E5-2600 v3 4th Generation Processor
- 4x DDR3L 2133MHz ECC RDIMM slots
- 4x 3.5" Hot-Swap HDD/SSD bays + 2x fixed 2.5" bays
- 1x (x8)+1x (x16) PCIe mezzanine slots
- Intel® I350 dual-port 1 GbE
- 1+1 High efficiency redundant hot-plug PSU

DreamMicro Power Server 2U D51B
From $2,699
RRP Inc-GST

Intel® Xeon® E5 v3
Up to 768GB Memory
10x Hot Swap Drives

- Intel® Xeon® E5-2600 v3 4th Generation Processor
- 24x DDR3L 2133MHz ECC RDIMM slots
- 10x 3.5" Hot-Swap HDD/SSD bays + 2x fixed 2.5" bays
- 1x (x8)+1x (x16) PCIe mezzanine slots
- Intel® I350 dual-port 1 GbE
- 1+1 High efficiency redundant hot-plug PSU

All prices include GST, exclude freight, all images are for illustrative purposes only. Errors and omissions excepted. Free 1 Year On-site Pickup & Return Warranty, 2 and 3 Years Optional.

· ISO 9001 Quality Endorsed Company QEC11489 · Commonwealth Government Endorsed Supplier 263 · State, Local, Government, Education Contract Supplier

PIONEER COMPUTERS

Build your own dream!

www.pioneer.net.au

1300 883 218 / sales@pioneer.net.au

Unit 2, 37 O'Riordan St, Alexandria NSW 2015 Australia
NSW: (02) 9690 2888 QLD: (07) 3257 3879 VIC: (03) 8790 1830 NZ: (649) 377 0497 Fax: (02) 9690 0333

Dreamcare.com.au

New online service and support for all brands of PCs, Notebooks and Servers.

msi®

KING OF MOTHERBOARDS

DDR4 BOOST & XMP LED
By fully isolating the memory circuitry from other components, DDR4 Boost ensures the memory signal to stay pure for maximum performance and stability.

GAME BOOST
Generate more FPS in games! Use the Game Boost dial with automated overclocking settings that goes up to eleven and reach for 5GHz.

AUDIO BOOST 3 & NAHIMIC
The ultimate audio solution for gamers, powered by Nahimic Audio Enhancer. With dual OPA1652 AMPs and metal EMI Shielding you get breathtaking sound quality.

OC DASHBOARD

Copper Contact

BIOS FLASHBACK+

GAMING LAN

USB 3.1 Type A

Audio Boost 3 with Nahimic

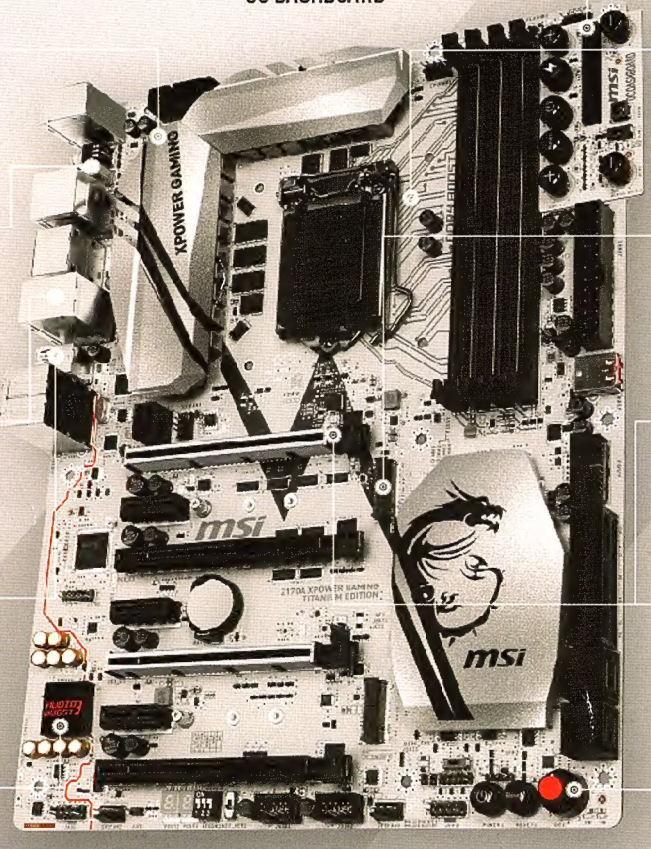
DDR4 BOOST

Twin Turbo M.2

Steel Armor

Multi-GPU

GAME BOOST



MOTHERBOARD

Z170A XPOWER GAMING TITANIUM EDITION

GAMING G SERIES

GAMING.MSI.COM

DEALER INFO

VIC
PC Case Gear
03 9551 0889 pccasegear.com

Centre Com Sunshine PTY
03 8311 7600 centrecom.com.au

EVA Tech
03 9020 7017 evatech.com.au

Landmark Computers
03 9701 3366 lmc.com.au

CPL
03 8542 8688 cplonline.com.au

BudgetPC
03 9541 9000 budgetpc.com.au

Scorptec
03 8561 3206 www.scorptec.com.au

TECS
03 9602 3499 www.tecs.com.au

BCC Computers
03 5227 6888 www.bcccomputers.com.au

PCD International
03 5222 5180 www.pcdi.com.au

Cnet technology Preston
03 9416 8886 www.prestontech.com.au

SA
Allneeds Computers
08 8211 8661 www.allneeds.com.au

NSW
Dcomp
02 4721 3457 dcomponline.com.au

PC Meal
1300 366 866 pcmeal.com.au

Mwave
1300 727 446 mwave.com.au

IJK International Pty Ltd
02 9745 0877 ijk.com.au

JW Computers
1300 592 667 jw.com.au

Digital Star
02 8748 6888 digitalstar.com.au

QLD
Computer Alliance Pty Ltd
07 3420 3200 computeralliance.com.au

Game Dude Pty Ltd
07 3387 1500 gamedude.com.au

Umart Online
07 3369 3928 umart.com.au

Digital Matrix Computers
07 4779 8054 digitalmatrixcomputers.com.a

WA
Austin Computers
08 9201 2788 austin.net.au

PLE Computers
08 9309 4771 ple.com.au

TAS
Taspro Computers
03 6424 1911 taspro.com.au

MSI Australia